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Advertisement Index, see page xx.

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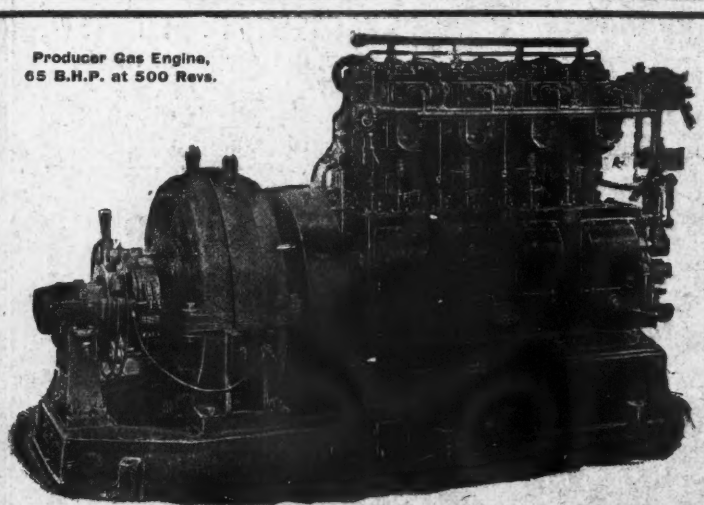

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THE

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Vol. LXXVIII.] CONTENTS: March 17, 1916. [No. 1,999.

	Page
The I.E.E. Wiring Rules	301
"To be Wound Up"	302
British Finance for Italian Trade	302
Lead	303
The Engineer in the Tropics, by G. R. Archdeacon	303
The Testing of Underground Cables with Continuous Current	304
Reviews	305
The Imports and Exports of Sweden	306
The Institution of Electrical Engineers and Alien Enemy Members	307
Correspondence—	
After the War: British Engineering Trade with China	307
An Engineer's "Wages"	309
"Wireless Wiring"	309
Meter Transformers	309
The I.E.E. and Alien Enemy Members	309
Reflectors for Half-Watt Lamps, &c.	309
War Items	309
New Electrical Devices, Fittings and Plant (*illus.*)	311
Legal	311
Business Notes	312
Notes	316
City Notes	318
Stocks and Shares	321
Market Quotations	322
The Renaissance of the Low-Tension Fuse, by J. A. Crabtree, (*illus.*) (*concluded*)	323
Continuous-Current Railway Motors	324
Control Equipments for Winders and Hoists (*illus.*)	325
Tar Oils as Fuel for Diesel Engines	326
Foreign and Colonial Tariffs on Electrical Goods	327
New Patents Applied for, 1916	328
Abstracts of Published Specifications	328
Contractors' Column	Advertisement page xviii

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THE I.E.E. WIRING RULES.

IN spite of the prevalence of war conditions, the Institution of Electrical Engineers has found time to carry out a revision of its wiring rules, and issued the 7th edition last week. The Wiring Rules Committee is a Standing Committee of 20 members, on which all the interests involved are represented, including the fire insurance companies, and we are glad to be able to state that *all* the latter have now adopted the rules; these are also accepted as standard practice by most of our electricity supply authorities, so we may congratulate the Institution and the industry on the excellent progress that has been made towards the universal acceptance of a single standard code, in place of the heterogeneous and chaotic mass of local regulations with which the contractor was confronted some ten or twelve years ago. The rules have been extended to include medium pressures (up to 650 volts)—a very necessary step in view of the amount of power that is supplied from the outers of three-wire systems and on three-phase networks at pressures between 400 and 500 volts—and it is interesting to note that provision has been made for the use of conductors with "tough rubber compound protection," under which disguise may be detected cab-tire sheathing. A table showing the capacity of conduits forms a very welcome addition, and an attempt is made to secure uniformity in the use of colours for distinguishing the conductors. Where possible, too, the work of the Engineering Standards Committee has been utilised.

The wording of the rules has evidently been very carefully revised, with great advantage in precision and lucidity, and numerous minor changes have been effected. One very commendable change is the abandonment of the definition of grade of insulated cable in terms of its insulation resistance—a misleading system, which was also to a great extent meaningless, owing to the wide range of values of the megohms per mile between the large and small sizes of cable. In place of this, V.R. cables are now to be graded as "I.E.E. 250-volt cable," and "I.E.E. 650-volt cable," a much more reasonable system.

Many changes have been introduced into the definitions and rules regarding conductors, etc., in the direction of greater safety and reliability; thus the size of insulated wire above which stranded conductors must be employed is reduced from No. 14 to No. 16 S.W.G., and in the case of flexible conductors No. 36 S.W.G. is made the minimum instead of the maximum size for each wire; for medium pressures heavy-gauge screwed conduit is specified;

switches having a handle projecting through an open slot in the cover are forbidden; the use of "hard metal" for fuses is no longer recommended, nor is it suggested that soft metal fuses should be soldered to metal plates; the "Home Office" pattern of wall plug is recommended, and the use of a cord grip for flexibles connected with wall plugs is specified, while it is advised also on portable appliances in no fewer than three identical clauses on three consecutive pages; and heaters consuming over 1,000 watts—as will the majority in future—must be fitted with double-pole switches.

The printing of the wire table in the rules instead of on a separate sheet is a distinct improvement; the only other change in it appears to be the elimination of the superfluous figures in the column giving the resistances of conductors per 1,000 yards, which were formerly carried to four significant figures—a useless refinement, seeing that a variation of 2 per cent. is allowed; in most cases two digits, and in the remainder three, are now employed, and are sufficient for all practical purposes.

On the whole, while the rules are not yet beyond criticism, we must congratulate the Wiring Rules Committee upon the results of its last revision; the wording, the composition, and the arrangement of the rules have been very greatly improved, and the changes that have been introduced in the regulations are such as will, we believe, command general approval.

"To Be Wound Up."

To all who desire to see success attend the British fight against German trade, the *London Gazette* has been of abundant interest during the last few months. Several issues have contained lists of companies, firms, and individuals with whom it is permissible to trade in China, where German scheming during the war has been extremely active. The reader naturally draws his own conclusions as to what his connections should be with those whose names do not so appear. In another issue, as we recently stated, there appeared lists of persons and bodies of enemy nationality or associations in Greece, Morocco, Netherlands, Norway, Portugal, Portuguese East Africa, Spain, and Sweden, with whom or which trading is prohibited. In these lists a number of electrical names are condemned. But last of all we have a number of issues of the *Gazette*, publishing the names of businesses in this country which, under the Trading with the Enemy Amendment Act, have been ordered by the Board of Trade to be wound up. Here, again, a number of electrical and allied names are recorded. We have quoted such of the 44 companies as appear to interest our readers, in our "War Items," but the announcement which will be welcomed most of all by the electrical trade is that which concerns the Electrical Co., Ltd. So long as the law permitted a business in which practically the whole of the capital was German owned, and the main purpose of which was to represent the Allgemeine Elektricitäts Gesellschaft, to continue trading, the matter was one of extreme difficulty, but it was, nevertheless, a blot on our escutcheon. We have watched the A.E.G. activities in this country, so far as it was possible to keep track of its operations, for many years. Its representatives came over here at a time when they were not viewed either with suspicion or with serious misgiving, and they laboriously and enterprisingly built up an organisation at great cost, which resulted in millions of pounds' worth of contracts being sent out of the country. Our industry was not in a state to resist the competition. The A.E.G. agents went in and out amongst us as respected gentlemen, notwithstanding all that we say to-day about the Teuton of these days not having the word "gentleman" in his vocabulary. They were, or seemed to be, Germans of the "old school"—if we may use the expression. We hope that, when the anti-German sentiment is so strong within us all, we shall not be misunderstood for stating these facts, for among other things that this disappearance of a company from our registers suggests to us, is the illustration that it affords within our own industry of the gross stupidity and shortsightedness of the Prussian scheme for world domination. There will not be a British electrical man who will regret the passing into oblivion of a concern which stood for the letters A.E.G. in England while that vast German organisation was engaged in manufacturing war supplies of so many kinds for the enemy. The senseless mutterings of its head, Dr. Walther Rathenau, recorded in our pages, about war being waged in the old Roman way, and the desires held in that quarter for making war on the British Empire, have not been without their effect upon the British electrical mind. They will not soon be forgotten after the war. Much blood has flowed on the Continent, and a record of infamy and shame has been written which has shocked the world. The Colonies are as determined as we are that neither this nor any other German organisation shall have things so much its own way in our markets in future as it has had in the past. The announcement now made gives final dismissal to A.E.G. activity in this country so far as it was represented by the Electrical Co. Parts of its organisation may have passed into other hands, and some of its staff and employés may be employed by indisputably British and neutral concerns, but the Electrical Co., Ltd., as such, in its capacity for earning profits whether on the sale of British or other goods, for German capital, is ended. The company's doings formed the subject of a good deal of correspondence in these pages a short time ago, and those who took part therein will not be disappointed at the course that events have taken. Further, those who were legally bound under contracts to supply goods to them will, doubtless, feel relieved that by the process of forced liquidation they are freed from their contractual responsibilities. The question that will naturally occur to many minds will be: Will the A.E.G., after the war, be permitted to "raise its head" again in the British Isles or in the Colonies? We wonder!

British Finance for Italian Trade.

British observers in Italy have been very definite in their warnings to British manufacturers that unless they take swift advantage of the opportunity, it will slip through their fingers. Italian buyers who long for freedom from Teutonic economic influence, and are determined that, if they have it in their power to decide, German penetration in Italian commercial and industrial affairs shall never again be what it was before the war, have shown signs of impatience with us because we have talked so much of bold intentions, but have seemed to delay the taking of appropriate action. But all movements are not shown upon the surface, and plans are often maturing for many months before the outside world knows anything about them. We believe that it will gratify our Italian brothers-in-arms as much as it will please the British commercial and industrial world, to learn that two of the best English banks—(the London County and Westminster, and Lloyd's)—as representatives of what is described as a "financial group," have entered into an agreement for the formation of an Anglo-Italian Bank for the purpose of developing the economic relations between the two countries and promoting commercial and industrial undertakings in Italy. The new concern will be made up of two companies—the British Italian Corporation in this country, and the Compagnia Italo-Britannica in Italy; the former will have a capital of

£1,000,000 and the latter £400,000. The financial group which is acting in the matter is very strongly backed. This move on the part of our financial leaders should give great encouragement to all who are desirous of assisting as traders in the fostering of commercial relations. And more than that, it augurs well for the strengthening of British financial facilities, and a more general co-operation with industry, in other countries where enlightened finance is unquestionably going to be one of the most important factors assisting us to be even with Teutonic competitors when the world is open to them again.

Lead.

The position of pig-lead has again been the subject of considerable interest lately. The price of this metal has kept at a very high level for some considerable time past, and most consumers were rather inclined to believe that this was partly the result of aggressive speculative buying. Recent developments, however, have certainly tended to dissipate that impression. With the intervention of the Government in placing lead, like most other metals, under the Defence of the Realm Act, thus eliminating all speculative transactions, business was naturally brought for a time to a complete standstill until the metal market was reopened under the new regulation. The market was then put to a test, and in a temporary absence of inquiries the price was depressed to the extent of 25s. a ton to about £31 15s., but there were not many sellers near that level, and the law of supply and demand reasserted itself to an extent which has soon resulted in the price being restored to the level at which it stood prior to the Proclamation. The strong underlying conditions having thus been more readily recognised, the ease with which the recent fairly large supplies were taken care of has tended to stimulate the covering of prospective needs over the spring. The market was in rather an excited condition in the course of the past week, with successive jumps in the price to about £34 a ton for next month shipment, the highest figure recorded since the years which followed the Napoleonic wars, and there was a further rise early this week. The price is admittedly extravagantly high, but it is well to bear in mind that the enormous war requirements now absolutely dominate the position. Never before in the history of the trade has there been so much lead wanted as at the present time, in spite of the comparatively reduced industrial requirements on this side. The present lofty level of values certainly affords every inducement for producers to push mining operations, but there is, of course, a limit to the forcing of the output, while, at the same time, efforts in that direction are liable to be frustrated by labour troubles as happened in the early part of this year in Australia. Operations in that quarter are now again running pretty smoothly, but labour tribulations have lately occurred in one of the chief mining districts in Spain, and this has not been without effect upon the temper of the market, though the latest news regarding the Spanish strike is a little more hopeful. In the course of the past year, the unusually large American surplus diverted to this country, following upon the huge increase in the American output in 1914, had the effect of keeping prices down for a time, but the American position is now much stronger. Domestic consumption has been considerably on the increase, so that the exportable surplus has been correspondingly reduced. The British market is thus more dependent upon the shipments from Spain and Australia in order to keep pace with the huge requirements largely in connection with munition work. Our imports for the first two months of this year were over 7,000 tons short of the same period last year, this deficit representing the shortcomings from America and Spain. The fact has to be remarked that the total Spanish exports for the past year show only an increase of about 9,000 metric tons against the previous year's returns. The position of lead has undoubtedly been complicated by shipping difficulties and labour scarcity in this country which tend to handicap smelters' operations, and Government action in that direction would possibly assist in affording some relief from the present stringent conditions.

THE ENGINEER IN THE TROPICS.

By GEO. R. ARCHDEACON, A.M.I.E.E.

It not infrequently happens that "in search of that bubble reputation" the electrical engineer penetrates the deadly swamps and forests of Africa, India, South America, or the Malay Straits. Before finally deciding upon the acceptance of an appointment in any tropical district the young engineer (who has been hitherto full of the wild desire to get out of England), when faced with the grave decision of accepting or refusing what at first sight seems a very tempting offer, will probably be troubled by such matters as (*a*) The high death rate obtaining in that particular district; (*b*) The outfit necessary; (*c*) The cost of living; (*d*) Social life.

The author has frequently been faced with these posers, and ofttimes has found his geography too weak to enable him even to locate the place offhand. To the untravelled engineer the tropics are wrapped in an atmosphere of mystery and death, and all his future success therein seems to hang upon the odds whether he will manage to live three years, or die within three months. The prospects of success and affluence are alluring, yet provokingly indefinite.

Upon one occasion, when a lucrative position in South America was offered to the writer, the managing director said, "If you stay in England you will have a fair amount of comfort and bread and butter; if you come with me you will have plenty of discomforts, but you will have jam upon your bread."

Let the young engineer bear this well in mind; in the Tropics he will not only have "jam on his bread," but he will live a freer life, and find unbounded opportunities for experience and progress. He will occupy a higher social position than a similar berth would carry at home, and the opportunities for saving are considerably greater than at home; but there are many pitfalls for the unwary. To save a reasonable percentage of one's salary necessitates a very strong will, and the exercise of that will must never be relaxed, for nowhere in Europe are the temptations so manifold as in the Tropics, coupled to which is the effect of a bad climate, which is constantly working upon one's health, and so reducing the vitality that gradually one's power of resistance decreases.

The question of total abstinence, or moderate indulgence in alcoholic drinks, in the Tropics, is perhaps one of the most vexed questions of the day. Each side has its strong adherents; each side possesses its convincing and conclusive statistics. The author does not pose as an authority on this subject, but, from personal observation and experience in various tropical districts, he advises total abstinence from all alcoholic liquors between sunrise and sunset; after sunset a moderate indulgence usually does no harm, but seems to act as a necessary stimulant.

The care of one's health in any tropical country must at all times occupy a serious portion of one's thoughts. Constipation at all times has evil effects, but in a tropical country its effect is simply deadly. Try and imagine the effect of the climate upon the average young Britisher who has all his life been used to cold fresh breezes, when he is suddenly dumped down, say, in the malarious and malodorous district of the river Amazon, where the temperature in his bedroom throughout the night is about 90° F., while the hydrometer shows about 85 per cent. to 95 per cent. humidity. One can well understand that living under those conditions one loses all desire for movement or exercise, and only cares to lounge about in pyjamas, with a long iced drink at hand. Exercise must be the watchword, and plenty of it, yet that is just the thing that one does not feel inclined to indulge in. This, again, is the occasion when the strong will must be exercised.

Another vexed question is quinine. Should one fortify oneself against malaria by taking, say, five grains per day, or not? If one takes quinine each day, trouble arises in the administering of it if one does (in spite of being charged with the drug) contract malaria. Here, again, we find the experts taking sides on this grave issue. Beyond doubt a daily consumption of quinine does appear to reduce the risks of malaria; therefore, on the principle of

"prevention is better than cure," the author is of the opinion (in spite of slight deafness frequently caused by the habit), that one should never neglect the daily dose of quinine when in a malarious district.

As regards the most suitable "first aid" remedies to carry, it depends largely upon what district is being considered—tropical diseases vary very much in the various districts; for example—

Yellow fever in Brazil, but never in India, Malay Straits or China.

Sleeping sickness and blackwater fever in West Africa, but never in Brazil, China, or India.

Malarial fever, however, is found in all tropical countries. Perhaps the most useful items to be observed are:—Vaccination against smallpox; inoculation against enteric fever; chlorodine for cholera and dysentery; quinine for malarial fever; corrosive sublimate for wounds and scratches; ice-cap in case of sunstroke.

Apart from the mosquitoes, chills are the most fruitful causes of illness, and they frequently lead to serious results. It is most important to avoid chills; many a man has gone to his grave through kicking off his sheet during the night and sleeping with the fan blowing a draught of cool air on to his body. A cholera belt should *always* be worn during the night.

The all-important question of clothes will, doubtless, require a considerable amount of thought. Again, local conditions must be inevitably the guide. Many districts have a fierce tropical summer, yet during the winter it is necessary to wrap up in thick furs and have a roaring fire in the bedroom. The style of one's clothes must be carefully considered. In India, Africa, and Malay Straits, white patrol jackets buttoned up to the chin are usually worn, whereas in Brazil, Hong-Kong, and Shanghai, white jackets cut in a similar style to our lounge jackets at home, showing white soft shirt, collar and tie, are considered the only possible wear for a gentleman.

To sum up the whole subject, life, to be fairly certain and healthy in the Tropics, should be (with a few reservations) maintained in a manner similar to that followed at home. The most important items to be observed are:—Plenty of exercise, plenty of sleep, plenty of good food, and plenty of optimism.

THE TESTING OF UNDERGROUND CABLES WITH CONTINUOUS CURRENT.

Mr. O. L. Record's paper on this subject was read before the Manchester Local Section of the Institution of Electrical Engineers on February 8th. An abstract of the paper appeared in our issue of February 18th. In the discussion the Chairman (Mr. B. Welbourn) said that the present knowledge of insulating materials dictated that A.C. overhead lines could only be constructed for a maximum pressure of 150,000 volts, but the information given in the paper would suggest that D.C. pressures of even 300,000 volts would be practicable for overhead lines. It would be interesting to know the highest limit of D.C. pressure which could be used.

Mr. C. J. Beaver said the distribution of stress with continuous current was quite different to that with alternating current; it depended upon different factors, viz.: resistance in the former case and capacity in the latter, therefore the effects would be quite different. The object of testing cables after laying was mainly to ensure that any damage incurred in laying was rectified. He did not entirely agree that there was no relation between the dielectric strength and the insulation resistance. The only advantage in size and weight of the Delon transformer lay in the fact that it had only to be designed for a small current. Sound dielectrics were not affected by pressures several times the working pressure, and the factors of safety employed ensured that the dielectrics were far removed from any such effects. Dielectric fatigue was simply the reaching of the limit of disrupture voltage of some component of the dielectric. The fatigue stage would, therefore, be far removed from any effect which could be brought about by such voltages as were likely to be applied to the cable under working conditions. A manufacturer might show some disinclination to take the responsibility for a cable suffering from things over which he had no control, but otherwise it would not interest him very much if the cable were tested repeatedly at twice working pressure. The most important question in connection with the D.C. apparatus was whether it would satisfactorily burn out faults. Wet cables were extremely difficult to break down, and the more water-logged the cable the more difficult the task.

Prof. E. W. Marchant said the relationship existing between the breakdown strength of material tested by direct current and alternating current was one of the most remarkable phenomena met with in electrical work. A cable having a non-uniform dielectric would have an entirely different distribution of stress in the two cases, the D.C. case depending upon the specific resistance of the material, and the A.C. case depending upon the specific inductive capacity. This was one of the reasons why the direct-current method of testing could not be regarded as entirely satisfactory. A number of tests had been made at Liverpool on the dielectric strength of ebonite, with the object of determining the amount of fatigue, which in ebonite appeared to be extremely small. He had tried to find what might be styled "mechanical fatigue," but the tests had failed to reveal it. He described a Wimshurst machine designed by Mr. Watson for direct-current testing, and giving an output of 4 or 5 milliamperes at 150,000 volts. Mr. Watson had also designed a special voltmeter reading up to 100,000 volts. The instrument was of the reflecting type, and was only a foot in diameter, the moving parts being arranged in a chamber filled with compressed air at 200 lb. per square inch pressure.

Mr. H. A. Radcliff thought the continuous-current test did not meet the requirements of a test under working conditions on alternating-current cables. The application of an excess alternating pressure was undoubtedly the correct method of testing A.C. high-tension cables before being put into service, and where possible it was advisable, before applying the excess pressure, to warm up the cables for several hours by circulating through them the maximum load current. This could easily be done using a suitable low-voltage transformer. Any test which ignored the effect of dielectric losses was necessarily incomplete. He agreed that there was no definite relationship between dielectric strength and insulation resistance. Insulation resistance or excess pressure tests were in themselves insufficient, and in future all tests of any value would include accurate measurements of the dielectric losses. In the case of sample lengths tested at the manufacturers' works, the pressure should be applied for several hours, and, if possible, a superposed low-voltage current equal to the maximum load should be passed through the conductors, all tests being made at normal working frequency. Whilst a high insulation resistance was not necessarily an attribute of a good high-tension cable, it greatly facilitated the location of leaky joints and fittings. The difficulties of testing with alternating pressure seemed rather magnified, as 12 miles of cable would never be tested at 40,000 volts with portable equipment. Tests after laying were usually made in lengths of about a mile, and after locating defects and making the joints, excess pressure was applied to the full length from the generating station or sub-station. Such a final test was required by the Board of Trade, and despite the energetic opposition of the cable makers it was likely to be repeated. He could not understand how a continuous pressure could ever be regarded as the equivalent of an alternating one.

Mr. F. Fernie considered that the curve showing the relation between breakdown voltage (A.C.) and duration of test was not always true. A certain paper-insulated cable broke down under test at 91.5 KV., but when 90 KV. was applied to another portion of the same cable for some hours there was no breakdown. The pressure was again applied and raised steadily until 91.5 KV. was recorded, and the cable again broke down. Other cables tested at the same time gave similar results. Similarly, the statement regarding the decrease of breakdown voltage with increase of frequency was not true for frequencies below 100; any decrease which did occur would certainly be under 5 per cent. Nearly all statements regarding dielectrics were to be accepted as true for a specimen rather than a substance.

Mr. H. M. Crellin said that experiments had shown that heating a cable to the temperature of boiling water did not perceptibly reduce the breakdown voltage. In the case of a cable damaged in laying, assuming the dielectric to be partially cracked so that it was composed partly of air and partly impregnated paper, with D.C. pressure the drop across the dielectric would be directly proportional to the resistance of the layers. It might easily happen with continuous pressure that the potential gradient would so adjust itself across the dielectric that the presence of a crack would remain undetected. On the other hand, with alternating pressure the voltage drop across the dielectric would be fixed by the capacities of the layers, and not the leakage current. Impregnated paper had a dielectric constant approximately three times that of air; consequently, as the potential gradient was inversely proportional to the capacity, the alternating pressure would easily spark across the crack, and so break down the fault. Regarding the ratio of D.C. to A.C. pressures referred to in the paper, it was not generally realised that the ratio of secondary to primary pressure of a transformer was considerably increased by the charging current of a cable due to the effect of the leading current on the magnetic leakage of the transformer.

Mr. J. L. Langton said the Delon apparatus would have a good application to the testing of line insulators *in situ*. His experience during the past year had shown that cracks due to temperature variations, expansion of cement, &c., were really the cause of the so-called fatigue in porcelain. Defects in insulators, which would break down with the usual transformer test, would not be disclosed by the Delon apparatus.

The smallest crack required alternate stress and heating in order to develop into a distinct fault. In air and in a solid insulation of mineral origin there was no relation between insulation resistance and dielectric strength. In the case of a solid insulation of vegetable origin, however, there seemed to be some relation, as moisture was a predominant factor when present in fibrous material. An increase in temperature would drive out moisture and increase the insulation resistance, but diminish the dielectric strength. Regarding the effect of frequency on dielectric strength, his experience with solids of mineral origin showed no difference between 33 and 100 cycles.

Mr. H. Alcock referred to the statement that the tests in question were only intended to show up faults produced in laying cables. The provision of a metallic test sheath interposed between the conductor and the lead sheathing already achieved this object, and further refinements seemed quite unnecessary.

Mr. J. W. Record thought the word "rectified" should be substituted for "continuous" in the title of the paper. The use of the cables instead of small condensers might easily involve a transformer of 300-k.v.a. capacity, such as was required in testing with alternating current. If such a test as was described should appear advantageous in future, it could only be put into operation after some competent authority had established the relationship between d.c. and a.c. pressures. The author's figures might certainly be laid down provisionally.

The Author, in a brief reply, said that in the case of cables for voltages at present in vogue, the margin of safety was so great that the question of fatigue was negligible. He cited a case where a 10,000-volt cable was subjected to 80,000 volts, after which the engineer had no qualms of conscience in testing at 20,000 volts, *i.e.*, double working pressure, every time there was trouble with the joints. With 50,000 or 60,000 volts the margin of safety was much smaller, and special precautions had to be taken. He did not advocate replacing the a.c. test altogether by the d.c. test. The capacity of the transformer was 3 kw., and this was actualiy effective power in the case of the d.c. test. Considering the extremely low power factor in the case of the a.c. test, it would be obvious that, in spite of the large capacity of the testing transformer, the effective power would be very small.

REVIEWS.

The Principles of Dynamo-Electric Machinery. By B. F. Bailey. London: Hill Publishing Co. Price 12s. 6d. net.

Much may be said in favour of the principle that professors and lecturers should expand their lecture notes into a text-book for the use of their students. When the lectures and text-books are co-ordinated in this way, advantages of uniformity of method and terminology in the instruction are much facilitated. If the resulting text-book is of sufficient originality and merit, it may prove valuable to a larger class than the one which is more immediately addressed by its author, and its wider publication is fully justified.

We take the work before us to be of the type which represents in somewhat expanded form a course of lectures on elementary electrical engineering addressed to a class of the author's students. Judged from this standpoint, the book is well written, and will doubtless serve a useful purpose. When regarded from the wider aspect of the more general public, it is more difficult to foresee a sphere of usefulness.

While it may be regarded as a well-written text-book for elementary students, there seems to be no marked characteristic or originality in treatment which is likely to render it more helpful to the ordinary student than the several excellent text-books covering similar ground which have been published in this country at a fraction of the price of Prof. Bailey's book. In fact, the reviewer would not feel justified in advising any student to invest so large a sum as the price asked for this volume on a purely preparatory text-book, unless he is more than usually fastidious in the matters of binding and typography—both of which are excellent in the present case.

Turning to the contents of the book, the author believes that the material which it contains will satisfy the needs of students who do not intend to follow electrical engineering as a profession, while he also anticipates its utility as a first course for students who expect to proceed further in the subject. Sparing use has been made of mathematical demonstration, and the author has generally explained his subject by reference to physical principles and employed methods of general reasoning, rather than rigid proofs. In this manner he has covered the field represented by the most important types of electrical generators, motors, and transformers, and has succeeded in conveying an idea of the main principles underlying their behaviour and use. His diagrams are clear, and where illustrations of actual machines and instruments are introduced they are generally well chosen and helpful.

It is obvious that when such a large amount of material is dealt with in a book of 300 pages the treatment of many portions is necessarily very slight, and it would be unfair to find fault with many omissions. It seems, however, a pity that no reference is made to magnetic leakage when dealing with field systems—especially as the student is asked to make calculations on the ampere-turns necessary to produce a given armature flux.

In view of the non-analytical treatment adopted in most parts of the book, it seems of doubtful utility to approach the principles of the alternating circuit in such an academic manner as is done in Chapter XII. Indeed, in this chapter the author seems to have departed somewhat widely from his plan of emphasising physical conceptions and avoiding such demonstrations as depend only on abstract mathematics and are wanting in appeal to the physical sense.

A good deal of the conventional mathematical treatment at this stage seems misplaced in a book intended mainly for the general and non-mathematical student, and such quantities as impedance and reactance need not have been introduced for the first time in the form of mathematical symbols and without any reference to their significance in practice. There seems to be no particular need to introduce the subject of electrostatic capacity and conditions for resonance at this stage, especially if the student is not distinctly warned against supposing that capacity and inductance are equally important factors in determining the impedance of the electrical circuits met with in the later chapters of the book.

Again, a certain number of rather advanced subjects are introduced, but treated in such general and superficial terms that the wisdom of referring to them at all seems open to question. One example of this is the single-phase induction motor, which is dealt with in three pages; even this short discussion seems to the reviewer to be lacking in clearness, which, it is only fair to add, is unusual in Prof. Bailey's book as a whole.

The reviewer's general impression is that for the non-electrical *student* the book may prove useful in conveying a general knowledge of the most important principles involved in electrical machinery; though, for the non-expert *user* of electrical machines, the treatment adopted is hardly the best. For the electrical student who hopes later to proceed further in his studies of electrical machinery, the book suffers from the fact that it deals too exclusively with principles and general statements, and provides an insufficient basis of concrete examples and definite results to enable the beginner to lay a good foundation for future studies.

The reviewer refuses to believe that it is wise to present the serious student with "the principles of dynamo-electric machinery" in a compass of 300 pages, especially when mathematical aids to abbreviation are little used.

Relativity and the Electron Theory. By E. Cunningham, M.A. London: Longmans, Green & Co. Price 4s. net.

This little work is one of the series of monographs on physics edited conjointly by Sir J. J. Thomson and Prof. F. Norton. As the author states, it is an attempt to set out as clearly and simply as possible the relation of the principle of relativity to the generally-accepted electron theory, showing at what points the former is the natural and necessary complement of the latter. Mathematical analysis has been omitted as far as possible with the object of rendering the account useful to the general reader, especially to the experimental physicist.

Of course, to the practical man the principle of relativity has very little bearing. He is apt to consider it and allied subjects as mere abstractions suitable as a study for those who have nothing better to do. Nevertheless, there are many desirous of keeping up-to-date with modern conceptions, and to such this little book of 90 odd pages can be commended.

The author, after discussing space and time in Newton's dynamics and the relativity of Newton's dynamics, goes on to show that time is not an absolute or independent concept. He then traces the advent of the æther theory and mentions Fresnel's convection-coefficient, and describes Fizeau's verification of Fresnel's hypothesis. The Michelson-Morley experiment is described and discussed at some length.

Towards the end of the work there is an interesting chapter on Minkowski's four-dimension vectors. Minkowski speaks of space by itself and time by itself as being mere shadows, and of only a kind of blend of the two as existing in its own right. He thinks of his four-vector as a single entity, just as we think of force as a single entity. The components of a force do not exist of themselves. They are only convenient means of specifying the force, which is one and definite. So space and time co-ordinates are to Minkowski only particular, complementary, and inseparable means of specifying a single fact or occurrence. Analytically, Minkowski transports himself to a space of four dimensions, in which the distinction between space and time vanishes. In this four-dimensional region the whole of space and time is portrayed in one construct.

The A.S.E.—The membership of the Amalgamated Society of Engineers has increased by 2,560 during the month of February to 208,825. This is a record for the society, which has secured about 30,000 new members since the war.—*Times.*

THE IMPORTS AND EXPORTS OF SWEDEN.

The following figures, showing the imports and exports in 1913 into and from Sweden of electrical and similar goods, are extracted from the official trade statistics which have just been issued. Unfortunately they are not as up-to-date as we should desire, the detailed 1914 figures not yet being available, but they are of interest as showing the course of Swedish business just before the war.

IMPORTS.

	1912. Kronor.	1913. Kronor.	Inc. or dec. Kronor.
Electric meters.—			
From Germany	808,000	1,068,000	+ 260,000
,, Great Britain ...	81,000	68,000	− 13,000
,, Other countries ...	7,000	10,000	+ 3,000
Total	896,000	1,146,000	+ 250,000
Electric incandescent lamps.—			
From Germany	1,016,000	1,166,000	+ 150,000
,, Austria-Hungary ...	16,000	32,000	+ 16,000
,, Holland	—	36,000	+ 36,000
,, Other countries ...	26,000	22,000	− 4,000
Total	1,058,000	1,256,000	+ 198,000
Dynamos and motors over 500 kg. in weight, and parts thereof.—			
From Germany	200,000	174,000	− 26,000
,, Great Britain ...	14,000	38,000	+ 24,000
,, Switzerland	—	63,000	+ 63,000
,, Other countries ...	8,000	23,000*	+ 15,000
Total	222,000	298,000	+ 76,000
* United States 12,000.			
Dynamos and motors up to 500 kg. in weight, and parts thereof.—			
From Germany	389,000	502,000	+ 113,000
,, Great Britain ...	16,000	22,000	+ 6,000
,, Switzerland	13,000	16,000	+ 3,000
,, United States ...	19,000	15,000	− 4,000
,, Other countries ...	34,000	40,000	+ 6,000
Total	471,000	595,000	+ 124,000
Electric cables covered with lead.—			
From Denmark	35,000	—	− 35,000
,, Germany	3,976,000	3,429,000	− 547,000
,, Holland	59,000	6,000	− 53,000
,, Great Britain ...	405,000	99,000	− 306,000
,, Other countries ...	33,000	41,000	+ 8,000
Total	4,508,000	3,575,000	− 933,000
Turbines.—			
From Germany	No details.	27,000	—
,, Great Britain ...		—	—
,, Other countries ...	—	106,000*	—
Total	4,000	133,000	+ 129,000
* Switzerland 105,000.			
Telephone and telegraph apparatus.—			
From Germany	47,000	87,000	+ 40,000
,, Great Britain ...	32,000	59,000	+ 27,000
,, Other countries ...	29,000	11,000	− 18,000
Total	108,000*	157,000	+ 49,000
* Includes wireless apparatus 11,000 kronor.			
Transformers and parts thereof.—			
From Germany	97,000	407,000	+ 310,000
,, Other countries ...	14,000	125,000	+ 111,000
Total	111,000	532,000*	+ 421,000
* Includes rotary converters.			
Accumulators.—			
From Germany	999,000	470,000	− 529,000
,, Great Britain ...	—	13,000	+ 13,000
,, Other countries ...	7,000	21,000	+ 14,000
Total	1,006,000	504,000	− 502,000
Rheostats, switches, &c.—			
From Germany	657,000	877,000	+ 220,000
,, Other countries ...	38,000	20,000	− 18,000
Total	695,000	897,000	+ 202,000

EXPORTS.

	1912. Kronor.	1913. Kronor.	Inc. or dec. Kronor.
Transformers.—			
To Norway	400,000	372,000	− 28,000
,, Spain	72,000	69,000	− 3,000
,, Other countries ...	59,000	102,000	+ 43,000
Total	531,000	543,000	+ 12,000
Electric dynamos and motors.—			
To Russia	85,000	153,000	+ 68,000
,, Great Britain	353,000	293,000	− 60,000
,, Norway	265,000	916,000	+ 651,000
,, Finland	147,000	213,000	+ 66,000
,, Denmark	173,000	241,000	+ 68,000
,, Spain	221,000	360,000	+ 139,000
,, Germany	72,000	21,000	− 51,000
,, Canada	375,000	557,000	+ 182,000
,, Other countries ...	625,000	922,000	+ 297,000
Total	2,316,000	3,676,000	+ 1,360,000
Electric incandescent lamps.—			
To Germany	32,000	—	− 32,000
,, Denmark	46,000	15,000	− 31,000
,, Great Britain	28,000	13,000	+ 15,000
,, Russia	13,000	—	− 13,000
,, Other countries ...	46,000	76,000	+ 30,000
Total	165,000	104,000	− 61,000
Telephone apparatus.—			
To Norway	107,000	43,000	− 64,000
,, Finland	419,000	223,000	− 196,000
,, Russia	1,069,000	334,000	− 735,000
,, Denmark	78,000	43,000	− 35,000
,, Holland	424,000	418,000	− 6,000
,, Great Britain	628,000	97,000	− 531,000
,, Mexico	177,000	86,000	− 91,000
,, British South Africa ...	373,000	210,000	− 163,000
,, Other countries ...	1,884,000	1,616,000	− 268,000
Total	5,159,000	3,070,000	− 2,089,000
Telegraph apparatus.—			
To Russia	51,000	1,131,000	+ 1,080,000
,, Holland	153,000	329,000	+ 176,000
,, Finland	54,000	182,000	+ 128,000
,, Egypt	—	152,000	+ 152,000
,, British South Africa ...	59,000	199,000	+ 140,000
,, Australia	—	110,000	+ 110,000
,, Other countries ...	145,000	615,000	+ 470,000
Total	462,000	2,718,000	+ 2,256,000
Water turbines.—			
To Finland	58,000	30,000	− 28,000
,, Great Britain	56,000	27,000	− 29,000
,, Canada	107,000	—	− 107,000
,, Japan	67,000	91,000	+ 24,000
,, Other countries ...	110,000	215,000	+ 105,000
Total	398,000	363,000	− 35,000
Cranes, &c.—			
To Finland	90,000	170,000	+ 80,000
,, Russia	175,000	198,000	+ 23,000
,, Other countries ...	245,000	401,000	+ 156,000
Total	510,000	769,000	+ 259,000
Copper wire.—			
To Russia	70,000	179,000	+ 109,000
,, Finland	100,000	193,000	+ 93,000
,, Norway	32,000	122,000	+ 90,000
,, Other countries ...	76,000	122,000	+ 46,000
Total	278,000	616,000	+ 338,000
Steam turbines.—			
To Russia	265,000	406,000	+ 141,000
,, Finland	47,000	28,000	− 19,000
,, Holland	20,000	49,000	+ 29,000
,, Great Britain	56,000	28,000	− 28,000
,, Other countries ...	126,000	101,000	− 25,000
Total	514,000	612,000	+ 98,000

Kronor = 1s. 1½d.

Insulating Tapes.—We have received from the Wholesale Electrical Co., Ltd., of 54-56, Oxford Street, W., samples of the insulating tapes made by the Canfield Rubber Co., for which they are sole agents in this country. The "Voltite" rubber jointing strip is stated to be superior to pure rubber for insulating joints and requires no rubber solution, the warmth of the hand sufficing to make a perfect union between the layers; it is a highly elastic material, and certainly appears to adhere to itself very tenaciously. Another sample of standard black adhesive tape has equally clinging propensities, and is closely woven and well coated with compound.

THE INSTITUTION OF ELECTRICAL ENGINEERS AND ALIEN ENEMY MEMBERS.

The informal meeting of Corporate Members to discuss the question of expulsion of alien enemies from membership of the Institution was held on Wednesday last week; there was again a good attendance, though many of the provincial members who attended the previous meeting were unable to be present. The President, Mr. C. P. Sparks, read a number of letters from members for and against the proposal, and stated that before calling the special general meeting to consider the resolution, the Council would ascertain the views of all the members by a post-card plebiscite.

Col. R. E. Crompton, who had to leave early, was the first speaker; he said he thought that the proposal to take the matter out of the hands of the Council indicated a want of confidence in the Council, and showed signs of hysteria, of which he was ashamed; they could afford to take the slight risk involved by having Germans amongst their members, but they could not afford to take the risk of displaying timidity or cowardice. He then left the room.

Mr. J. S. Highfield said he regarded the question as of intense importance; they might take hasty action now of which they would be ashamed in the future. The Council had not the power to expel aliens, but ought to be provided with such power. They had alien members who had become British subjects, and no *bona-fide* British subject should be ejected. Under the old German law, after a period of residence abroad for ten years a German automatically lost his original nationality, and, similarly, he lost it on taking out letters of naturalisation abroad; but a law was enacted in 1913 under which a German might obtain the permission of his Government to become a naturalised British subject and yet retain his German nationality; such a person was the worst kind of alien, and should certainly be expelled. He agreed with Col. Crompton that the powers of the Council should not be curtailed.

Mr. J. H. Rider, after reading a letter from Sir John Snell expressing his approval of the proposal, said that genuine naturalised British subjects ought not to be expelled; but alien enemies should be expelled, and never re-admitted. He disclaimed the possession of hysteria. He would have supported the original resolution if it had clearly covered all subjects of an enemy State without dispute. He concluded by proposing a resolution to expel all enemy subjects, and to exclude them permanently, also placing the onus of proof that he had ceased to be an enemy subject upon the shoulders of an applicant for membership.

Mr. C. H. Wordingham, declaring that the Council was by no means pro-German, said that they must consider only the interests of the Institution as an Institution. To him it was an offence to have to associate with a German; if not all Germans had committed crimes, at any rate, no German had dared to protest against them, or would refuse to commit them if ordered to do so. He would exclude all Germans, now and after the war, until the present generation had had time to die out. Some naturalised Germans unquestionably ought to rank as Englishmen; but there were no means of finding out whether a German had been denaturalised or not. Those who got naturalised in order to work for their own country were infinitely more dangerous than avowed Germans who were not naturalised. If a man became naturalised for the purpose of gain, was he worth having? Most naturalised Germans were closely connected with Germans in Germany, and it might be necessary to sacrifice the genuine in order to make sure of removing the traitors. There was no hysteria about him—he had always felt an aversion to Germans. Let them show signs of repentance; then we might consider the question of forgiveness. They should beware lest the trouble were allowed to recur.

Mr. W. Rutherford sympathised with the proposal, but felt that they must differentiate between those who had done many years' good work for this country and others who had not. He asked what was to be done about "neutrals" who were working in Germany against us, and pointed out that an Englishman was regarded as innocent until he was proved to be guilty.

Mr. A. Gay raised the question of voting by ballot on the resolutions, and proposed that all aliens of enemy origin, even though naturalised, should be expelled. He would not trust *any* German.

Mr. W. L. Madgen drew attention to the benefits which this country had derived from alien immigration, but supported the proposal to expel subjects of enemy States.

Mr. Ll. B. Atkinson said that the most hysterical speaker was Col. Crompton, and it was not fair that he should run away from the meeting. As for taking power out of the hands of the Council—the Council had not adequate powers at present to deal with the matter, and there was no question of want of confidence; they wanted an automatic process of exclusion. He would retain naturalised members if they were also denaturalised in Germany. His aim was to show that they would not associate with people who were hand-in-glove with this "den of thieves."

Mr. A. A. Campbell Swinton also maintained that a really naturalised alien who retained no allegiance to his native country could not be expelled. Mr. L. Joseph thought that all enemies should be dealt with, including neutral members known to be working against us in Germany, and that it was important to keep them out of the Institution. Mr. Berkeley suggested that all of enemy origin might be swept out, and those afterwards reinstated who were worthy. Mr. W. M. Mordey pointed out that a large meeting could not possibly settle a form of words; it would be better to agree on principles and leave it to the Council to embody them in a resolution.

Mr. J. C. Wigham protested against the whole of the proceedings, which he thought would not help to end the war; would the amenity of Europe never be restored? and should they imitate the Germans in petty actions, rather than risk retaining one or two dangerous members? Mr. Irwin also advocated moderation.

Mr. Frank Gill supported Mr. Mordey's proposal, and asked whether they were legislating for the present war only, or for every future war. He would prefer to leave the matter in the hands of the Council. Reading the letters of naturalisation, he pointed out that the question was a very difficult one, but that it would be better to suffer some injury than to tear up the agreement made with naturalised aliens. Britain had entered the war because Germany broke her agreement with Belgium.

Mr. J. E. Kingsbury thought they should abide by the laws, and obey the rules by which the Institution was governed. The German nation was not a member of the Institution; they had to deal with individual Germans. To expel naturalised Germans, he thought, would be improper and unlawful. A middle course was advisable, and was provided in the resolution that had been put before them at the previous meeting.

Mr. G. W. Partridge thought that not the Council, but the members should decide what ought to be done. Dr. S. P. Thompson associated himself with Mr. Kingsbury and Mr. Mordey, and thought that they should not deal with aliens *en bloc*, but should give power to the Council to act. He believed that there were no German members who had been naturalised since January 1st, 1914. The whole thing was, in his opinion, a petty matter; but he would support the resolution if the responsibility of acting was left with the Council.

Mr. T. O. Callender said that Dr. Thompson's remarks to some extent justified the suggestion that the Council was pro-German. The members clearly wished to relieve the Council of the necessity of picking and choosing aliens for attention.

The President pointed out that at the previous meeting he represented the Council, whereas on this occasion he had called upon individual members of the Council to speak, and would also speak for himself as a Corporate Member. Most divergent views were held inside the Council. Personally, he would not vote for the exclusion of naturalised members; he drew from history arguments in support of the *bona-fide* immigrant. He then put to the meeting in rotation the various points that were in question, taking the resolution which Mr. Rider had prepared as the basis. First, voting by ballot was almost unanimously rejected; the expulsion of subjects of enemy countries and of "naturalised" aliens who had retained their original nationality was approved by an enormous majority; it was decided that naturalised aliens who were formerly subjects of a State now at war with this country, but who could prove to the satisfaction of the Council that they had lost their alien nationality, should not be excluded, and finally, by a majority of 2 to 1, it was agreed that no subject of an enemy country should be eligible for election to membership of the Institution in the future.

On the proposal of the President, it was agreed that a committee consisting of the Vice-Presidents, Messrs. Highfield, Smith, and Wordingham, and Dr. Russell, and four members should settle the wording of the final resolution to be submitted to the Institution, and Messrs. Atkinson, Swinton, Gill, and Rider were nominated for this purpose. The meeting was then adjourned.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

After the War: British Engineering Trade with China.

The Electrical Review of December 24th, 1915, reached Hong-Kong only a couple of days ago. It arrived on New Year's Day, Chinese Calendar (our February 3rd). In the Far East, China New Year's Eve is the most important day of the year; not only in business, but in family circles. For on that day every debt transacted during the previous twelve months must be settled. The Chinese shopkeeper is most patient concerning credit at all other times of the year, but he does expect, and demands, payment on, or before, China New Year's Eve. The reaction follows. During New Year's Day, and almost for a week afterwards, all business is suspended. A perfect orgy of cracker firing and feasting marks the beginning of the holiday. If you are fortunate enough to have friends among the Chinese, you pay numerous calls in the morning of their New Year's Day; then, when that duty

is done, you may enjoy that greatest of all delights for the exiled engineer, read and digest the technical papers from "home."

During the morning of February 3rd the writer called upon some prominent local Chinese. In all cases the conversation flowed mainly along trade channels. It had been a good settlement. There was plenty of money about. It seems that the Chinese are anxious to invest their money in British companies in Hong-Kong and Shanghai. There has been a most extraordinary "boom" in shipping. The Chinese are born gamblers, and they rush to the fluctuating share market. Shipping and rubber companies have been entertaining them in a manner which causes them ecstasy. My friends, who are fortunate, tell me of shipping shares which have trebled in value in the past year. Even that staid and steady institution, the Hong-Kong and Shanghai Bank, which we Britishers think as stable as the Bank of England, even that has presented to the Chinese opportunities for gambling or speculation, whichever you like to call it. When the war commenced there was a fall in the shares. If, in that August of 1914, you had faith in the British Empire and bought "Banks" at 700 dollars, you can sell them to-day for 830 dollars. Which, together with the demand for, and rise in, the shares of the British shipping companies, goes to show that faith in the British Empire has greatly increased in the Far East. It must be very annoying to those Germans who are spending all of their Boxer indemnity money, and a good deal of their own spare cash, in proving to the Chinese that the British Empire is a back number.

It is quite useless to expect the Chinese to do any work during their New Year holiday. If they were at war they would most certainly refuse to fight at such a time. There is an enforced vacation, not only for students, but for all contractors and mechanics. Since the writer is employed, normally, either in teaching Chinese students the hidden mysteries of British machinery, persuading contractors to install the same in his laboratories, or seeing that mechanics and coolies keep it in working order, he took a compulsory holiday from such things. Having paid his respects to his Chinese friends, he spent the rest of the vacation with those best of all English companions, the technical papers. And it seemed that wherever his eyes wandered, the home journals were full of trade problems and discussions.

In the issue of the Electrical Review mentioned above, the following, from the list of contents, proved of an enticing nature: First of all came the article "British Business Methods which must go." Then "Trade Statistics of the Straits Settlements." Next "Exports and Imports of Electrical Goods during November, 1915." Finally, the two pages devoted to "After the War," which gave the views of members of those two very dissimilar British institutions, the House of Lords and the B.E.A.M.A. Although the report of the discussion by members of the B.E.A.M.A. was only awarded small type, it seemed more entertaining than the opinions of Earls and Viscounts.

The first-mentioned article deals with problems of finance as applied to engineering schemes. So much has been written on this subject with reference to the market in China that little else remains to be said. It may be of interest, however, to repeat that the Chinese people do not like to pay in advance. One reason why the theatre does not flourish in their country is that they don't like paying for an entertainment of whose value they are uncertain. There is the story of the German who introduced a kinematograph at Chengtu, a place many hundreds of miles inland. It is situated in the province of Szechuan, which European geologists and mining engineers report as containing in abundance almost all the minerals used by engineers. When the picture show commenced no one would patronise it. "Fancy paying money for a thing you cannot see before you part with your cents," they said in amazement. Finally the thing succeeded; but only because money was lost at first. The astute Teuton gave a few free performances, and probably collected his money as the people left the entertainment, well pleased with themselves and the show.

The "Trade Statistics of the Straits Settlements," which give the imports of electrical and other materials into the various Straits Settlements during 1914, are important, for the people who have made the Straits Settlements are the Chinese, aided by the British Government. The latter has ensured for the former a fair field and just taxation. The former have developed the natural resources of the place. The largest individual donor to the Hong-Kong University is a Chinese millionaire in the Straits Settlements. He emigrated from a place about 100 miles away from Hong-Kong, with less than the proverbial sixpence. A combination of stable government, undeveloped natural resources, and the amazing industry which is a characteristic of the Chinese, has made this man a millionaire. One of my students tells me that even he, a great example of up-to-date enterprise in the Straits, uses the most elementary methods for working his valuable tin mines. Apparently, nearly a quarter of a million pounds' worth of electrical machinery and similar materials was sent from Great Britain in 1914. A great deal was sent from other countries. It is the Chinese who are creating the demand.

The "Exports and Imports of Electrical Goods during November, 1915," show, as a feature, the large Russian business. China and Siam—where the Chinese also flourish—took about the same as Canada. But Hong-Kong took nearly twice as much, and Hong-Kong is the distributing centre for South China. Again, the Straits Settlements took more than Hong-Kong. Japan and Korea took more than twice as much as the Straits. It is very probable that a great proportion of the goods for Japan were re-shipped to North China. The writer has evidence of the Japanese buying quantities of expensive surveying instruments in England for use on Chinese railways. These places, in the Far East, took 10 per cent. of the British exports of electrical goods, despite the fact that, during the same month, Russia took 20 per cent. of the total. After the war . . . it seems feasible that, with all of the money available at China New Year, 1916, with knowledge of the fact that money is to be made in engineering enterprise in the Far East, with the natural resources available and undeveloped—it is feasible that after the war the electrical imports to the Far East will increase.

The report of the discussions under the title "After the War" shows that, despite the terrific strain of the awful struggle in Europe, our Statesmen and our business men are really thinking out these problems of overseas markets. "Viscount Haldane . . . prophesied that when peace came we should be found less prepared for it and its problems than we were for war." But were we really so unprepared for war? It apparently took our Statesmen several months to reach a conclusion which Mr. Lloyd George announced with all the pride of a man making a wonderful discovery. "This is an engineers' war," he said, months and months after the technical papers had reminded their readers of what every engineer knew instinctively in August, 1914. The Statesman will be unprepared for the realisation that when the fighting in Europe is over there will be another war in the markets of the world. That, also, will be an engineers' war.

At the B.E.A.M.A. meeting Mr. Lee Murray put the great problem which must be solved by Britishers in a dozen words: "Having got the equipment," he said, "it was necessary to get the foreign market." This was perhaps a less explicit way of saying what Mr. T. C. Elder pointed out earlier in the meeting: "British engineering had given an amazing example of industrial development. Its productive capacity had increased enormously during the past 15 months, and the shock of peace would be more staggering if the industry did not make timely preparations. The capital invested, the plant laid down, and the workers trained, to meet war needs, must all be utilised." This is a real problem which needs carefully thinking out. The solution involves the development of the natural resources of other parts of the world. It dazzles the imagination to think of the trade boom which will come about when the natural resources of China are utilised for the use and convenience of man. Mr. Dunlop was not strictly accurate when he said "Japan had secured virtual control of Chinese internal trade." There is still plenty of opportunity for British manufacturers. The market must be cultivated.

We have seen the seamy side of German morality, even in the Far East. We have read of the Bryce Commission, the *Lusitania*, and the other infamies. In 1912—two years before the war—the writer spoke about the need for Britishers to combine against these traders. We know their brutal outlook, and we loathe them. But, just as we have copied their lead in the matter of high explosives and machine guns, so must we copy some of their enterprising methods to secure trade.

When the German Government established themselves in Shantung Province, North China, they quickly discovered that the Chinese farmers were poor. They found out that the soil was worked out, and fertilisation was done in an elementary and crude fashion. They sent out fertilisers from Germany. They notified manufacturers, and they provided a market for them. German moneylenders supplied the necessary credit. When the money came in from the first crop, which was a splendid one, they obtained good interest. Thus the Chinese farmer benefited; so did the German manufacturer of fertilisers, the German moneylender, the German shipping company. The prestige of the German increased with his trade.

Just as in this war in Europe, the British engineering manufacturer is overhauling, and will finally smash, Krupps, so will he obtain his full share of the trade which must be obtained when the war is over. He has done well in the past, but he will do much better in the future.

Wherever you go in China you will find the seven cent Mei Foo (amiable and trustworthy) lamps of the Standard Oil Co. These lamps have created an enormous demand for kerosene, so that all over China you find the kerosene tin used as a receptacle for the household fluids. A certain firm of tobacco manufacturers are as ubiquitous. Just at present China has awakened to the advantages of electric light. The metallic filament lamp is competing with the seven cent Mei Foo, even in places where they seldom see a white man. The beat of the steamship and motor-boat is heard on the inland waterways. It is all pioneer work, but it is encouraging to those who believe in progress. It was Great Britain who first saw the possibilities of trade with China, in the days of King George III. We have sufficient faith in the British manufacturing engineer to believe that he will reap a good crop in the Chinese market after the war. He will do so because he will make the necessary effort.

C. A. Middleton-Smith, M.Sc.

Hong-Kong University, *February 6th*, 1916.

An Engineer's Wages.

I have read with interest the remarks passed under the above heading in your current paper, and as a graduate of similar qualifications as the advertiser in question, I wish to state since the conclusion of my college training, that is last June, I have been unable to obtain a suitable position, whether of a technical or practical character.

Twice my applications were not favoured even with a formal reply. All I am offered is a mechanic's work with "low wages," and I have come to the conclusion that experienced, mostly practical, men are those wanted, while qualified technical men, fresh from the college, find little encouragement in their work.

Experience.

London, *March 12th*, 1916.

"Wireless Wiring."

I see in your issue of the 3rd inst. that you have reproduced my letter to Mr. F. Miller, of the G.E.C., and I only hope that those who read it will not be led away with the idea that we are having a time of all play and no work. The original intention was to give an entertainment to our own men at Christmas, and to run the show for three evenings, but owing to the huge appreciation it met with we continued for the week. Afterwards we were commanded to run a week at each of two other places where English troops were congregated. This we did, and, I am pleased to say, gave a pleasant evening to an aggregate of over 15,000 men. . . .

I have been out here since the very commencement and am fairly well hardened, but am looking forward to that much-spoken-of period—"after the war."

Arthur E. Watts (Corpl.).

[Corpl. Watts need have no misgivings; our readers well know that their friends and brothers at the Front are not out there for fun, and there is not one who would grudge them the pleasure of an entertainment on the rare occasions when Corpl. Watts and other enterprising and able organisers have the opportunity to provide it. We only wish such opportunities were more frequent, and we congratulate our correspondent upon the striking success of his efforts.—Eds. Elec. Rev.]

Meter Transformers.

I should be extremely obliged if you or any of your readers could tell me the name and publisher of any book dealing exhaustively with the design and special characteristics of small current and potential transformers for meter work only.

Meter Engineer.

The I.E.E. and Alien Enemy Members.

The signatories to the following letter addressed to the Institution prior to last Wednesday's meeting will be obliged if you will be kind enough to publish it in your next week's issue.

W. T. Anderson.

[*Copy.*]

P. F. Rowell, Esq., *Secretary*,
The Institution of Electrical Engineers,
Victoria Embankment, London, W.C.

Dear Sir,—Several members of the Institution who cannot attend your meeting in London to-morrow feel that it may assist those present to arrive at a satisfactory resolution if they have before them a copy of the addition to the rules of the Engineers' Club, Manchester, which was adopted when the members had the same problem before them. The rule in question reads:—

"No one of German, Austrian, Turkish, Bulgarian, or other alien enemy birth or nationality, whether naturalised or not, may be introduced into the Club, either as a member or as a visitor."

It is agreed that this wording is not suitable for the Institution, but they suggest it might be modified somewhat as follows:—

"No one of German birth or nationality, whether naturalised or not, may remain a member of this Institution after (*date*) or be introduced into the Institution in the future, either as a member or a visitor."

Further wording will be necessary to bring this rule into general conformity with the existing Articles, but this may safely be left to the Council's legal advisers.

(Signed) S. L. Pearce.
W. Walker.
H. T. Wilkinson.
H. Allcock.
W. T. Anderson.

Manchester, *March 7th*, 1916.

Reflectors for Half-Watt Lamps, Etc.

In your issue of December 17th, 1915, we offered for sale by fig. 8 a pattern of reflector for half-watt lanterns, subsequently alleged by the Benjamin Electric, Ltd., to be an infringement of one of their Registered Designs. At the time of said issue we were unaware of the existence of said registered design. Without prejudice to any rights we may have, we entirely withdraw said pattern fig. 8, and all lists which may contain said pattern. Said lists by numbers 6,811-2, 6,819-20, 6,808 and 6,809 also show additional patterns alleged by the Benjamin Electric, Ltd., to be infringements of certain of their registered designs, and these additional patterns we also, without prejudice, entirely withdraw.

Townshend's, Ltd.,
E. Townshend, *Director.*

Birmingham, *March 10th*, 1916.

WAR ITEMS.

Exemption Applications.—The Trafford Park Estates Co., Ltd., appealed to the Stretford Tribunal last week for the exemption of a consulting electrical engineer on the ground that he was employed in an occupation in which it was in the national interest that he should be retained. He had attested, and was in group 21. In answer to the Tribunal, he said he resided and had his business in London, but for the greater part of each week he was in the service of the company in Manchester. The point was raised whether the attested man, being a consulting engineer, was an employé of the company, and one member suggested that the point might be referred to the Central Tribunal in London. In the end, however, the claim was disallowed.

Among a number of conscientious objectors to military service, who appeared before the Oldham Tribunal last week, were two men employed as instrument makers at the electrical works of Messrs. Ferranti, Ltd. They said they had not left their employment because they were on civil work, and the meters they made were for private houses. It was pointed out to them that they could not tell whether the work was civil work or not, and that the logical position for them was to have left their employment and found other work which they could be certain had nothing to do with the war. The members of the Tribunal made it clear that they did not suggest that the men were doing wrong in working at the electrical works named, but it was suggested that they were not acting consistently. The men were referred for non-combatant service.

At the Wigan Tribunal application was made by Mr. H. Bull, assistant electrical engineer, for the exemption of a meter inspector and repairer and tester of installations. It was stated that his services were of great value. There were men doing twelve hours' shifts in several of the departments, and if they left it was not known how they would be replaced. The electricity department had already lost 25 to 30 per cent. of its employés. Three months' postponement was granted.

The Cardiff Tramways and Electric Lighting Committee was asked to consent to an appeal being made to the Tribunal for three lighting attendants. The request was made on the ground that the department was already much depleted in staff, and that male labour could not be obtained for the work, which was unsuitable for women. The Committee declined to appeal for the men, and Councillor J. Taylor said that if the need came and the work must be done, Councillor F. W. Blower and himself were prepared to help to do it.

At the Herne Bay Tribunal Mr. A. R. J. Creasey, electrical engineer, asked for absolute exemption on business grounds, and because he was doing work of national utility. On his application the case was heard in private. On the re-opening of the court the Tribunal allowed a fortnight's exemption, adding: "This will give you, with the two months which you have got under the Act, ten weeks in all."

The "Times" states that, at the County of London Tribunal, an assistant electrical fitter and storekeeper, whose firm is engaged on an Admiralty contract, was allowed a month's postponement so that he may complete the job on which he is at present engaged.

At the Darlington Tribunal an application by an electrician, carrying on business on his own account, was refused. It was stated that since his case was heard on a previous occasion he had made no effort to wind up his business.

At Eastbourne an electrician claimed that he was in business for himself, and if called to the Colours he would have to "close down." His application was refused.

At the Bury St. Edmund's Tribunal application was made on behalf of the manager of the electricity works, and exemption granted so long as he remains in his present position. Exemption was sought on behalf of the chief working electrician employed at the works, and in his case also exemption was granted so long as he continued in his present employment.

Before the Clacton Tribunal the electrical engineer engaged by the Urban Council applied for exemption in respect of an electrician and switchboard attendant. The application was based on the grounds that the man was

employed in public service as a temporary substitute for an enlisted man, that it took seven months to train him for the work; and that the staff at the electricity works was already reduced to a minimum. Exemption was granted conditionally on the man remaining at the present occupation.

Before the Hampstead Tribunal, an electrician engaged in business at Kilburn applied for exemption for an employé. Asked whether his application was made on the ground of national importance, he replied that he would have to give up the whole of his business. He had tried to get somebody else to do the work, but mechanics could not be found. The Tribunal said that no appeal on the ground of national importance had been made, and exemption was not granted.

The "Times" states that a manufacturer of dry batteries applied to the Islington Tribunal for the exemption of a young man to whom he had imparted his trade secret. The applicant said the making of dry batteries was largely a German business, and there were only two manufacturers besides himself in this country who had been successful in making the proper article. He had three sons at the front. He was negotiating for Government contracts. Rather than instruct another stranger in his secret he would give up the business, which employed 80 to 100 people, and sacrifice £70,000. The Tribunal decided that the applicant must get a badge for the man if he was to be exempted.

The Wolverhampton Tribunal granted a three months' extension to the managing director of a firm of manufacturers. The applicant stated that he had discovered to some extent a secret process in the treatment of steel for electrical purposes, which had been previously exclusively used in Germany.

The Imperial Tramways Co., Ltd., applied to the Stockton-on-Tees Military Tribunal for the exemption of the company's chief storekeeper and cashier on the ground of indispensability. One hundred and ninety-eight members of the staff had joined the Forces, and there was not now an unattested man of military age in the company's employ. The Chairman granted postponement for three months, with liberty to apply again.

At Nelson Tribunal, on March 9th, the Tramways Committee appealed in respect of the traffic clerk. Captain Smith (for the military) said the clerk was not fully experienced, and was only put in the position recently. The Tramways Committee could put a rejected man in his place. The tramways manager said the trams would have to stop if the man went. It was absolutely impossible to go on working. The department had been reduced materially. Only 13 were employed on work similar to that they did before the war. A month's exemption was granted.

At Blackpool Tribunal, on March 9th, Mr. Furness, electrical engineer, appealed for four single men employed in his department. The Mayor said the men were indispensable. There were 107 men at the beginning of the war, and 43 had enlisted. Mr. Furness had been one of the keenest recruiters on the committee. These were technical men whom it would be impossible to replace. Mr. Furness said the men were sub-heads of departments. He was not there on personal grounds, but as representing the Corporation. One was engineer-in-charge, and when on shift duty was responsible for all the machinery. If he could replace them with married men or men unfit for service he would do so. It was beyond human endurance to expect men to go on week after week doing two men's work. There were 30 to 50 advertisements appearing every week in the electrical papers seeking engineers and offering them war badges as a protection from military service. He would not keep any man out of military service if his place could be filled. Conditional exemption was granted.

At Southport, last Friday, Messrs. F. W. Smith & Co., Ltd., electrical engineers, of Southport and Manchester, sought exemption for James W. Smith, the manager of the Southport office and a director of the firm. It was urged that he was in a "starred" trade, but the military representative said that he could find nothing in the list of reserved occupations except relating to electricians connected with public electricity supply works. Postponement to May 1st was granted.

Electrical and other Companies to be Wound Up.—Further orders, issued by the Board of Trade under the Trading with the Enemy Act, 1916, require the following businesses to be wound up:—

Electrical Co., Ltd, 122-124, Charing Cross Road, London, W.C. Controller: Maurice Jenks, 6, Old Jewry, London, E.C.

Balashol Belting Co., Ltd., 13, Lambton Street, Sunderland. Controller: William Swan, 31, Moxley Street, Newcastle-on-Tyne.

British Graetzin Light, Ltd., 26-36, Chapter Street, Westminster, S.W. Controller: Thomas Wise, Bassishaw House, Basinghall Street, E.C.

Jaeger Bros., 9, Rathbone Place, Oxford Street, W., manufacturers and suppliers of electric lighting accessories. Controller: Maurice Jenks, 6, Old Jewry, London, E.C.

Hanover Rubber Co., 105, Goswell Road, London, E.C., rubber goods merchants. Controller: Geoffrey Bostock, 21, Ironmonger Lane, E.C.

Exports to China.—The "London Gazette," of March 10th, contains a further list of seventeen bodies or persons to whom articles to be exported to China may be assigned.

Women in Industry.—The President of the Board of Trade, after consultation with the Home Secretary, has appointed an advisory committee with the following terms of reference:—

1. To advise the Board of Trade and Home Office on questions arising from time to time out of measures required to be taken by those departments to give practical effect to the policy of His Majesty's Government of extending the employment of women in industrial occupations so as to enable essential industries to be maintained in spite of the depletion of their supply of male labour by recruiting for war purposes; and

2. To watch and report from time to time on the progress made in different localities and industries in the extension of the employment of women.

Mr. F. Lavington, of the Board of Trade, and Mr. M. H. Whitelegge, of the Home Office, have been appointed joint secretaries to the committee.

Birmingham and Enemy Contracts.—At Birmingham City Council last week Sir William Bowater, replying to a question, stated that the Manchester resolution urging that no contracts should be entered into with enemy firms, had been discussed by the General Purposes Committee, but it was not considered necessary to deal with the question. "Some councils in the country," he added, "seem to have time to pass abstract resolutions, but we have not here." The General Purposes Committee thought the best thing to do was to order the resolution to lie on the table.—"Morning Post."

An Ediswan Piano.—A concert was recently held at the Edmonton Military Hospital, at which a piano, stool, and invalid chair were presented by the Ediswan staff and employés. The idea of the presentation originated with Miss F. Wootton, a member of the Ediswan staff at Ponders End, who started a collection amongst the staff and employés of the company, a grand total of £33 being got together. The talent on the occasion of the concert was chiefly contributed by those in the service of the Edison and Swan Co.

An Electrician!—At the Richmond (Yorks.) Tribunal, an electrician applied for exemption on conscientious grounds. Replying to questions, he declared that he would do nothing to oppose the landing of Germans in England, and expressed the opinion that he would be as well off under German as British rule. If women were violated he would not interfere, but would look upon such incidents as accidents. At this stage the Tribunal declined to listen further, and refused the appeal.

Enemy Trade in Egypt.—The "Times" correspondent at Cairo says that the Egyptian Government has appointed a special Commission on Commerce and Industry to examine the extent to which the industries and commerce of the country have been affected by the war, and to propose measures for opening up new markets for Egyptian products and for replacing articles formerly obtained from enemy countries by articles either locally produced or imported from non-enemy countries.

War Relief Funds.—Since September, 1914, the employés of the India-Rubber, Gutta-Percha & Telegraph Works Co., Ltd., at Silvertown, have been contributing to various funds, and the total is now £1,300. Nearly £700 has been sent to the Prince of Wales's Fund, nearly £350 to the British Red Cross Society, £260 to the Belgian Relief Fund, and lately contributions to the Serbian Relief Fund and the Anglo-Russian Hospital at Petrograd, have been started.

"No Room for Germans."—This is a familiar battle-cry of our Australian brothers in their fight against German trade influence, and we read that the Sydney Legislative Assembly has passed the first reading of a Bill to disqualify, during the period of the war, all enemy-born subjects from voting at municipal and parliamentary elections.

The Foreign Trade Department.—The daily press states that a list of business men to act in an advisory capacity has been submitted, at the request of the Foreign Trade Department, by the London Chamber of Commerce.

Swansea Corporation Contracts.—A special committee of Swansea Corporation has resolved that no contract shall be entered into with any person of German or Austrian birth, or with any firm controlled by such persons.

Russia and the Trade War.—More than a thousand members of the Russian War Industries Committees have assembled in Petrograd to report progress and to concert more intensive action.—"Times."

No German Members.—The Council of the London Chamber of Commerce has resolved that no German or Austrian born subject, naturalised or not, shall be eligible for election as a member of the Chamber until otherwise determined by the Council.

Electric Motor Vehicle Construction in the United States.—**According to a report lately issued by the U.S. Bureau of the Census, in Washington, the number of electric motor vehicles constructed in the United States during the year 1914 was 4,715, an increase of 22·9 per cent. over the output in 1909.**

Electrical Trades Benevolent Institution.—**The annual meeting of this Institution will be held at the Institution of Electrical Engineers, on Monday, 27th inst., at 2.30 p.m. The report and accounts for the year will be submitted, and members of the Committee of Management and the auditors will be elected.**

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Lineman's Shoe.

An American company has developed a new insulating shoe for electrical workers; throughout their entire life a pair of these shoes, the manufacturer states, will provide the wearer protection against circuits at pressures up to 20,000 volts, and will not cause the discomforts of many rubber shoes.

The shoes contain no cement and have no seams, but are vulcanised into a solid piece under high pressure on aluminium molds. No hand work is employed in the process.

The white soles are made of a rubber composition like that employed in certain types of coal miner's shoes, which have been found to give 18 months of constant wear. When this white sole wears through, a layer of red rubber, which will itself withstand a pressure of 20,000 volts, is exposed. The appearance of the red rubber is a signal or reminder to the wearer that, although his shoes will still withstand 20,000 volts, a new half sole should be immediately cemented or vulcanised in place. No metal is used in any part of the shoe.—*Electrical World.*

Western Electric Interphones.

The Western Electric Co., Ltd., of Norfolk House, Victoria Embankment, W.C., have brought out a neat and well-made pattern of intercommunication telephone, as illustrated in fig. 1.

The case is of walnut, with plated fittings, and the hand microtelephone switch is arranged so that the same instrument can be adapted for use either as a table set or wall pattern; pressing the button of the line required, both selects the line and rings up the station, and to answer it is only necessary to remove the hand-set from the switch. Replacing the hand-set automatically restores all the keys to the normal. The system is arranged for central-battery working, so that only two batteries are required, one for speaking and the other for ringing. Standard sizes are made for 6, 12, 18 and 24 buttons. It is claimed that by the judicious combination of light metal framework, light woodwork and ornamental plated fittings, an instrument strong enough to stand the heaviest service, and yet neat in appearance and of small dimensions, has

Fig. 1.—Western Electric Co.'s Interphone.

been devised, and certainly we can find no fault with the result, either inside or outside the case. For convenience of examination and adjustment, the top cover opens on a hinge, and, for access to the cabling, the whole body is hinged to the backboard. The hand-set is fitted with a capsule transmitter and a bipolar receiver.

Electric Invalid Chair.

There has recently been illustrated in the *Daily Mirror* and elsewhere, an electrically-propelled invalid chair of a type which is excellently adapted for the use of convalescent patients in hospitals, and, indeed, for use on the sea-front promenades around our coast and at inland health resorts.

This chair, which has been constructed by the Elieson Electric Traction Co., of 85, Newman Street, W., and is the invention of Mr. C. P. Elieson, is equipped with an Elieson 40-volt traction battery, carried under the seat, which supplies current to a low-speed motor, of about ¼ H.P. rating, which is fitted under the hood in front of the vehicle, and drives by means of a vertical shaft and worm gear, giving a 20 to 1 speed reduction, the two front wheels of the chair. The occupier of the chair controls its movements by a small lever placed on one side of the chair, which gives four speeds, and in a fifth position applies a band brake sufficiently powerful to hold the vehicle on a hill. A small interlocked reverse switch near the control lever provides for the same speeds, &c., being obtained by the latter in a reverse direction.

The chair weighs roughly 2½ cwt., the battery accounting for 60 lb., and the apparatus over the front wheels about 80 lb., of which the motor weighs 35 to 40 lb.

On a normal charge the carriage will travel some 20 miles on a level surface, the battery discharging at the rate of 4 or 5 amperes

Fig. 2.—Elieson Electrically-Propelled Chair.

under such conditions and the speed being 4 or 5 miles an hour. We illustrate in fig. 2 the electrically-propelled chair, with the inventor, Mr. Elieson, at the helm; we understand that the vehicle attracted considerable attention at one London hospital where its capabilities were informally demonstrated, and judging by the interest taken in the first announcement of its appearance, there should be a considerable future for it.

LEGAL.

The War and German Telephone Contracts.

In the King's Bench Division, on Monday, Mr. Justice Bray had before him an action brought by the Birmingham Private Telephone (New System) Co., Ltd., against the Deutsch Privat Telephon Gesellschaft and H Fould & Co., of Frankfort-on-Main, and Mr. Alfred Gunz, formerly chairman and managing director of the plantiff company, and now interned as an alien enemy, for a declaration that three contracts, dated January 4th, 1911, were determined by the outbreak of war, and ceased to be binding.

Mr. Disturnal, K.C., appearing for the plaintiffs, said that they were an English company incorporated in August, 1911, and carried on business as dealers in private telephone installations. The company was promoted by Mr. Gunz to take over and work in the Midland Counties three contracts between himself and the German company, by which he held the exclusive right to dispose of the German company's goods in the counties of Stafford, Worcester, Warwick and Salop, and agreed not to buy or deal in any other apparatus than that sold by the German company. The contracts were to last for 35 years, and they were terminable by six months' notice. Mr. Gunz also undertook to form a company to take over the obligations and benefits of the contracts. Though the plaintiff company was formed in 1911, Mr. Gunz did not make a formal assignment of the benefits and obligations of the contracts before the outbreak of the war, but the companies worked together as if such an assignment had been made and the plaintiff company had been substituted for Mr. Gunz. In November, 1914, however, he purported to execute an assignment of the contracts to the plaintiff company. Mr. Gunz had since got rid of his shares in, and ceased to be a member of, the company, which was now being worked with English capital and by English directors. But it was impossible for the company to carry on business unless it could enter into contracts for the purchase of goods from English manufacturers. Therefore, the company came to the Court and asked for a declaration that the contracts between Mr. Gunz and the German company were determined by the outbreak of the war.

Mr. F. T. Jackson, managing director of the plaintiff company, said that the capital of the company was £2,500. Up to the outbreak of war the plaintiff company had disposed of about 2,000 instruments and the average price was about 55s. each. Since the war Mr. Gunz had ceased to be a director and shareholder of the company. The present directors and shareholders were all British subjects. There were about seven similar companies in this country.

Mr. Hogg (for Mr. Gunz) said his client had no interest in the contracts, and did not want to do anything to interfere with any right the plaintiff company might have to any declaration his Lordship thought fit to grant. But, as he had been made a

defendant to the action, he desired to take the point that German contracts should be construed according to German law.

Mr. Justice Bray thought that unless the contrary was proved the presumption was that the German law was the same as the English law.

Mr. Hogg said there might be a difference between the German law and the law of this country on the point whether the contracts were dissolved or suspended by the outbreak of war. As to the royalty of 1'60 mark, counsel submitted that the liability to pay that sum was not extinguished by the war. Under the contracts certain apparatus had to be supplied by the German company to Mr. Gunz, who had a specified time within which to take them over. At the outbreak of hostilities a great deal of stock belonging to the defendant company was in the possession of the plaintiff company. If it had not been taken over that stock remained the property of the German company, and the plaintiffs had no right to take it. Therefore in any declaration his Lordship made it was necessary to safeguard the position with regard to apparatus not taken over by the plaintiff at the outbreak of war.

Mr. Justice Bray granted a declaration that the contracts were determined at the outbreak of the war. The royalty of 1'60 mark, he said, formed no part of the price of the goods, but was part of the consideration which the German company received as long as the contracts continued. As the contracts had been determined, the right to the 1'60 mark ceased. He did not think it was necessary for him to deal with the last question raised by Mr. Hogg with regard to the goods consigned by the German company.

Judgment was entered for the plaintiff company, without costs.

British Thomson-Houston Co., Ltd., *v.* Stonebridge Electrical Co., Ltd.

Mr. Justice Younger in the Chancery Division on March 10th heard a procedure summons taken out by the plaintiffs in this action asking for further and better particulars of the defendants' particulars of objection to the plaintiffs' patent.

Mr. Hunter Gray, for the plaintiffs, said they were suing in respect of an alleged infringement of patent, and by the present summons they were asking for further particulars of the objections raised by the defendants against the validity of the plaintiffs' patent. The point raised by the summons was a somewhat important one, and dealt with the objection of the defendants that the plaintiffs' invention was not good subject matter for a patent by reason of the common and public knowledge at the date of the letters patent. There was a difference, contended counsel, between common and public knowledge. Common knowledge was what was known to be in the possession of every person in a particular trade or business. On the other hand, public knowledge was only something that was available to everybody who desired to possess it. No particulars of common knowledge were required. Where a patent was alleged to be bad because certain knowledge was to be found in some document, then, he argued, particulars of the document should be given. He submitted that on every ground on which a patent was disputed the defendant must give such particulars as would enable the issue to be brought properly before the Court. It would not be right that the plaintiffs should be met at the trial with a document of which they had never heard.

Mr. Frost, representing the defendants, submitted that there was no such distinction to be drawn between common and public knowledge as that attempted to be drawn by Mr. Gray, because public knowledge was common knowledge. There it was enough for the defendants to say it was public knowledge that tungsten could be drawn, and it was not necessary to give page and passage in some document. Plaintiffs did something so obvious that it could not be an invention. There was no need to give the reference on which they relied.

Mr. Justice Younger: Must not the plaintiffs know the basis or grounds for your objection that it was public knowledge?

Mr. Frost said he would prove that by evidence. The plaintiffs asked for documents, as if public knowledge could only be proved by documents. If they had to give particulars the plaintiffs would say that having alleged a specific document they were not entitled to rely on any other document unless they amended their pleadings

Mr. Gray was heard in reply, and at the conclusion of the arguments his Lordship reserved judgment.

Belfast Slander Action.

The Master of the Rolls, in the Irish High Court, refused, with costs to the plaintiff, an application on behalf of the defendant in the action by Mr. A. B. Farrell, resident superintendent of the Belfast central electrical station, against Mr. T. W. Bloxam, Belfast city electrical engineer, for alleged slander in connection with work at the station, for leave to issue an interrogatory. It was urged that plaintiff had obtained an order for interrogatories, and that defendant had complied with the order. Defendant now wished to interrogate the plaintiff as to the reason why he believed the alleged slanderous words were spoken maliciously. The application was opposed on plaintiff's behalf.

British Electric Traction Co., Ltd. [Capital Reduction.]

In the Court of Appeal composed of the Master of the Rolls and Lords Justices Phillimore and Warrington on Friday, the hearing was resumed of the appeal of the Public Trustee, as the executor of the late Mr. Leopold Salamons, the holder of £12,960 non-interest bearing income certificates of the British Electric Traction Co., Ltd., from an order of Mr. Justice Astbury, sanctioning, upon the petition of the company, a reduction of its capital, and also sanctioning the scheme of arrangement so as to bind the various classes of shareholders and also the holders of income certificates issued by the company. By the scheme of arrangement as sanctioned by the judge, the non-interest bearing income certificate holders were given in full satisfaction of their certificates 10 per cent. of their face value in new cumulative fully-paid preference shares, and 25 per cent. of their face value in fully paid ordinary stock. The case for the appellant was that he was not bound by the scheme, as it might be that the acceptance by him of the shares as fully paid would involve him in some future liability.

At the conclusion of the arguments of Counsel, their Lordships dismissed the appeal with costs.

BUSINESS NOTES.

American Electrical Exports.—The American *Electrical Review and Western Electrician* says that the total value of the electrical exports for last November broke all previous monthly records. The November total exceeded that of a year ago by nearly 67 per cent. For the four electrical classes for which quantities shipped are given in the Government reports, there were exported last November the following:—Electric fans, 3,943; arc lamps, 114; carbon-filament lamps, 121,672; metal-filament lamps, 658,005. The classified electrical figures for the month are as follows:—

	Nov., 1915.	Nov., 1914.
Batteries	$184,903	$44,136
Dynamos or generators	58,850	112,784
Fans	55,849	3,825
Insulated wires and cables	302,089	78,652
Interior wiring supplies, &c. (including fixtures)...	79,580	53,189
Lamps—Arc	2,115	860
Carbon-filament	13,186	5,408
Metal-filament	98,703	22,379
Meters and other measuring instruments	85,113	32,061
Motors	293,540	337,792
Telegraph instruments (including wireless apparatus)	12,154	3,350
Telephones	30,308	143,777
Transformers	170,632	115,955
All other	1,357,825	690,555
Total	$2,744,847	$1,644,723

Book Notices.—*Universal Electrical Directory.* 1916. London: H. Alabaster, Gatehouse & Co. Price "A" Edition, 12s.; "B" Edition, 21s.—The thirty-fifth annual edition of this directory has just been published. It takes its now very familiar form, and is divided up into a number of sections, giving home, Continental, Colonial, and general, also American, names and addresses in alphabetical order, and arranging the principal of these in classified trades' sections. The British geographical section appears as usual, and should prove as useful as ever, as should also the exhaustive and valuable collection of particulars concerning electric light and power systems in all parts of the world. For those at home who are interested in Colonial and foreign trade development it possesses a special usefulness at such a time as this, and for the buyer abroad it brings together in an up-to-date form all the particulars that he requires in order to get into touch with makers of British manufactures of which he is in need.

"*Proceedings* of the Physical Society." Vol. XXVIII, Part 2. February 15th, 1916. London: The *Electrician* Printing and Publishing Co., Ltd. Price 4s. net.

"Electrical Apparatus-Making for Beginners." By A. V. Ballhatchet. London: Percival Marshall & Co. Price 2s. net.

The Central, Vol. XII, No. 38, contains articles on "The Hardening and Annealing of Metals," by R. G. Parker, and "The Photographic Industry," by F. F. Renwick, as well as the usual "Old Student Notes," Reviews, &c.

"Wiring Rules" of the Institution of Electrical Engineers. Seventh edition. London: The Institution, or Messrs. E. & F. N. Spon, Ltd. Price 6d. (post free, 7d.).

Electric Light Switching Competition.—We are informed by Messrs. A. P. Lundberg & Sons that all past records have been well beaten in regard to the number of answer papers received in respect of the examination questions sent out by them last month. We also understand that the quality of the papers is exceptionally high in all three grades. For the first time the ladies have entered the field. There are still the papers to come in from oversea competitors, who are naturally given a longer time to compete.

Patent Restoration.—An order has been made restoring Patent No. 24,949, of 1910, granted to Heenan & Froude, Ltd., and Fred. Harrison, for "Improvements in Dynamometers."

Bankruptcy Proceedings. — J. R. Whitehouse, managing director of an electrical company, Golder's Green. Receiving order made on March 9th at Barnet, on a creditor's petition.

G. J. T. J. Parfitt, consulting electrical engineer, Keynsham. —Trustee released, February 10th.

German Samples from Brazil.—The Board of Trade Commercial Intelligence Branch in London has received from the Acting British Consul-General at Rio de Janeiro samples of German electrical goods imported into Brazil. These may be seen at the Foreign Samples Section at 32, Cheapside, E.C. They include brackets, lamp sockets, porcelain rose sockets, porcelain insulators, fuses, commutators, bell accessories, reflectors, &c.

Trade Announcements.—Messrs. Ernest G. Denner and Co., wholesale electrical engineers, of West Street, Sheffield, have taken new premises with stores, at 284, Glossop Road, where all communications should be addressed. The stores are in Victoria Street.

Messrs. Thermit, Ltd., with a view to centralising their business, have removed their registered offices to new premises recently erected at the works, 675, Commercial Road, London, E. Telephone No.: "East 4157."

C.T.S. Authorised. — The St. Helens Cable and Rubber Co., Ltd., draw our attention, with pardonable pride, to the fact that under the title "tough rubber compound protection" the Institution Wiring Rules, as newly revised, recognise and approve of the use of cab-tire-sheathed cable without conduits or wood casing (Rules 33 and 65). The company, however, do not propose to substitute "T.R.C.P." for the well-known "C.T.S."

Catalogues and Lists.—Messrs. D. Hulett & Co., Ltd., 55 and 56, High Holborn, London, W.C.—Illustrated circular stating prices of special shades for screening electric lamps.

Teleklyt Cable and Para Rubber Co., 38, Bath Street, Glasgow.—Illustrated circular giving prices and particulars of pocket voltammeters and voltmeters, also switchboard surface meters.

LIGHTING AND POWER NOTES.

Accrington.—Ald. Higham speaking recently on the subject of the electricity department, said the minimum of extensions were being carried out to enable them to cope with increasing demands, and would only partly remedy their difficulties, the plant being seriously overloaded. If the gas plant was not doing all that was expected, it was due to inability to get suitable fuel for the producers and to by-products being commandeered. He anticipated a heavy and unavoidable loss on the year's working.

Ashton-under-Lyne.—Price Increase, &c.—After the current quarter, charges for current are to be increased by 10 per cent. for lighting purposes and by 25 per cent. for direct-current power and heating purposes.

The borough electrical engineer, his assistant, and the mains superintendent have applied for remuneration for extra services necessary through the depletions of the staff caused by enlistments, and it has been decided to grant a bonus of £100 for the year commencing March 25th next.

Bradford.—The Finance Committee of the Guardians recommends agreement with the proposal to light the new buildings at Bowling Park Colony with electricity, and that a guarantee be given to the Corporation ensuring a minimum revenue of £150 per annum for a period of seven years.

The Electricity Committee has given instructions for the preparation of the foundations for the proposed new cooling plant, and to obtain quotations for the requisite additional feed pumps; application is to be made to the L.G.B. for the necessary borrowing powers for the additional plant.

Burton-on-Trent.—Price Increase.—To meet the extra cost of coal, amounting to about £2,000, the Electricity Committee has decided to increase the price of electricity by 15 per cent., as from March 31st. The question of insuring both the electricity and gas works against air raids has been considered and they are to be fully covered.

Canada.—The Ontario Government has decided to purchase, for £1,670,000, the Consolidated Electric Power Co. and 22 subsidiary companies operating in Central and Eastern Ontario. The acquisition of these concerns will enable the Government to duplicate in Eastern Ontario the work already done by the hydro-electric system in Western Ontario.

Church Stretton.—Prov. Order.—The U.D.C. has given its consent to the Church Stretton Electric Supply Co.'s application for a provisional order for the supply of electricity within the urban and rural districts of Church Stretton.

Continental. — Italy. — Half-Watt Lighting. — According to the Italian journals a good deal of attention is being given to the substitution of half-watt lamps for arc lamps in the streets of Italian cities. As mentioned on p. 286 of our last issue, the authorities in Rome have largely adopted this type of lamp and a similar substitution of lamps is occurring at Brescia, Parma, Naples, &c. At Brescia some 400 ½-watt lamps, of 600-c.p. size, are now in use in the principal streets, the lamps being supplied in groups through 24-kw. transformers, or in emergency from the private supply network. It is held that there are considerable operating advantages in this type of lamp, but it requires more current and the light falls off in time. At Parma there are installed 250 680-c.p. lamps, which are run in series groups and provided with supplementary resistances. About 50 100-c.p. lamps have also displaced gas lamps, and the results are regarded as technically and economically satisfactory. At Naples an experimental installation of 60 ½-watt lamps is being made in place of arc lamps in the city's principal street; these will be run in series of 10, with supplementary resistances, with a view to using existing lighting circuits.

Owing to avalanches in the Agondo Valley, the Falcade electric works and many other buildings, have been destroyed.

Dover.—The Government has renewed a loan of £157,000 for seven years from May 6th, with power to pay off at six months' notice after five years, the rate of interest to be ½ per cent. above the rate payable on the last War Loan, with a minimum of 5 per cent. The L.G.B. has sanctioned a loan of £3,814 for new cable.

Dublin. — Estimates.—A report submitted by the Electricity Supply Committee to the Estates and Finance Committee in connection with the general rate estimates for the coming year, states that the sales to March 31st should work out at 8,529,826 units, comprising 4,339,364 lighting units and 4,190,462 power units, the former a decrease, compared with 1915, of 69,167 units, and the latter an increase of 345,595 units. The receipts should work out at £113,297, an increase of £18,386 over 1915. Taking into account the surplus brought forward from the 1915 accounts of £7,940, together with the anticipated surplus from the current year's working, it is expected that the income for 1917 will meet the running and maintenance expenses, and provide for the annual capital charges, provided that the cost of coal does not exceed 27s. 6d. per ton. The estimated increase in expenditure is £11,325, and it is pointed out that the cost of coal increased by £11,523 over the previous year, and the cost of carbons by £645, while the cost of general maintenance materials rose by from 25 per cent. to 65 per cent. The Estates and Finance Committee concurs in the views expressed in the report.

Eastbourne.—Price Increase.—The T.C. has decided to increase the charge for electricity for lighting purposes from 5d. to 5½d. per unit, as from April 1st next.

Edinburgh.—Heating Charges. — The E.L. Committee has decided, with a view to abolishing duplicate wiring and meters, to adopt the system in use in Glasgow for charging domestic consumers, *i.e.*, to charge the consumer for a fixed number of units for lighting, the amount being based on the average use by such consumers, and to charge all units in excess at a low rate, in this case 1½d. per unit. The scheme will come into force on May 15th.

Exeter.—Workhouse Lighting.—The B. of G. has, by 10 votes to 7, rejected a proposal in favour of deferring until after the war the introduction of the E.L. in Block 3 of the institution, at a cost of £50 or £60.

Glasgow. — Fire. — According to the daily papers, damage amounting to £2,000 was caused by a fire in the electric generating building of the Victoria Infirmary recently.

Ilkeston.—The Tramways Committee has fixed the lighting rate at 4d. per unit, with reductions for quantity; for power the charge will be 2½d. to 1¾d., according to consumption, and for heating, &c., 1¾d. per unit. Electricity supplied through prepayment meters will be charged 4½d. per unit.

Ipswich.—Tale of a Destructor Loan.—The L.G.B. has refused sanction to a loan for £5,200 for duplicating the refuse destructor, apparently because the Council entered into contracts for the plant before the work had been sanctioned. It appears that the latter course was taken under pressure by Government departments, including the L.G.B. itself, and this fact is to be brought to the notice of the latter, with a view to its sanctioning the borrowing of the money.

London.—Hampstead.—The B.C. has adopted the recommendations of the Electricity Committee that the estimated deficit, £3,528, for the year ending March 31st next, on the Council's electricity undertaking, shall be met out of the reserve fund; and that the charges for electricity be increased by 10 per cent. as from the beginning of the next December quarter, and that six months' notice to this effect be given to all consumers.—*Hampstead Express.*

Fulham.—The Electricity Committee recommends an expenditure of £950 on cables and equipment to supply Townmead Engineering Works, which firm has guaranteed the Council a revenue of not less than £1,000 during a period of three years.

With reference to the linking-up of the Battersea and Fulham electricity undertakings, the Committee has received an application from the Battersea B.C. for a supply of at least 700 kw. for

the ensuing year; it is probable that the Battersea demands may amount to some two or three million units per annum, and, under the agreement, the cost per unit payable to the Fulham Council will be materially affected by the price of coal.

The Battersea B.C. having made satisfactory arrangements for coal supply for the next 12 months, anticipates that, in view of the supply of electricity in bulk, its coal contracts may exceed its requirements, and suggests that the Fulham Council should accept the transfer of 4,000 tons of coal at 20s. 7d. per ton.

Lowestoft.—Price Increase.—The T.C. has agreed to an increase of 10 per cent. in the charges for electric lighting and heating supply.

Middlesbrough.—The Corporation Finance Committee has ordered that no profits shall be taken from the electricity and gas undertakings in relief of rates, as owing to the L.G.B. refusal to sanction capital expenditure, it will be necessary to utilise profits for extensions during the ensuing year. The electricity department last year contributed £2,000 towards the relief of rates.

Newmarket. — Street Lighting. — The Electricity Co. has refused the offer of the U.D.C. to pay £1 per lamp per annum for certain public lighting on account of restricted lighting, and has asked for £4 per lamp. The matter has been referred to a Committee.

Shaldon.—E.L. Scheme.—The Teignmouth U.D.C. has informed Dr. J. Purves, with reference to the establishment forthwith of an E.L. installation at Shaldon, that, upon the work being completed, the Council is prepared to pay for public lighting by electricity at an agreed sum, but without any minimum payment as to restricted lighting.

Sheffield.—Amongst the "considerable items" of new capital expenditure by the Corporation, recently mentioned in the "Current Topics" column of the *Sheffield Daily Telegraph*, is £307,000 for electric power extensions. The electricity department's revenue for the year now closing is estimated at £277,000, or £150,000 more than in 1914. Seven years ago the receipts were only £77,000. The writer of the column proceeds to advocate an increase in the price of electricity, apparently with a view to the department emulating the tramways "as a popular reducer of the rates," and forgetful that cheap electricity may be achieving the same result in a less ostentatious manner.

Southport. — A large electric cooking installation has been fitted at the Southport station of the L. & Y. Railway.

St. Anne's.—The electrical engineer to the D.C. reported that the sale of energy for lighting and traction purposes in January showed a decrease, but the increase in the consumption for power purposes enabled the department to show an increasing total output.

Stafford.—For the purpose of extending the Corporation's electricity works, the Council has decided to purchase the adjoining land for £1,000, subject to the approval of the L.G.B.

Swansea.—Electric Cooking.—Subject to the approval of the Board of Education, the Education Committee proposes to install electric irons and a cookery stove at the domestic subjects centre. The Electricity Committee has instructed the engineer to make arrangemente with the present contractors for the supply of coal to the electricity station for the continuance of their contract for a period of one month, and recommends that, in the meantime, tenders be invited for a supply for periods of three, six, nine, and 12 months respectively.

Torquay.—Loan Sanction.—The L.G.B. has informed the T.C. that it is prepared to sanction loans of £1,578, £3,518, and £3,550 for electricity purposes, and £3,252 on account of the new electricity plant.

U.S.A.—The Northern California Power Co., of San Francisco, like several other companies, has taken advantage of the present high price of aluminium to dispose of certain of its transmission lines, for which copper lines of increased capacity have been substituted. The proceeds of the aluminium wire taken down have been sufficient to cover the cost of copper wire of greater capacity together with the labour and other costs involved.

Walsall.—Motor Hiring.—The Electricity Committee of the T.C. has made arrangements with the British Thomson-Houston Co., to supply motors on the deferred payment system. The department will install the necessary wiring where such motors are supplied to consumers. Finding it difficult to obtain suitable men to fill the vacancies, the electrical engineer is applying to the War Office for the return of a shift engineer and sub-station attendant, who have enlisted.

Weybridge.—The Urban Electric Supply Co., Ltd., has applied to the U.D.C. for consent to erect overhead wires to supply a local works. The request has been referred to a Committee for consideration.

Whitehaven.—New Plant. — Permission has been given for the manufacture for the Council of a 150-kw. generator; and the order is to be placed as soon as possible, and the cost met out of revenue.

Wigan.—We understand that Mr. S. L. Pearce, of Manchester, has informed the Corporation that he is unable, at the present time, to undertake the preparation of a report on the Council's electricity undertaking, as proposed by the T.C. and mentioned in these notes last week.

Wolverhampton.—Loan Sanction.—The L.G.B. has sanctioned the borrowing by the T.C. of £1,085, for laying mains to supply local firms.

The estimates for the year were recently considered by the T.C., when it was remarked that no contribution of profit from the electricity undertaking was included; Councillor Evans mentioned that a report on the subject was expected, and further intimated that the Council had a right to expect that arrangements would be made to ensure the customary dole to rate relief next year.

TRAMWAY and RAILWAY NOTES.

Accrington.—Tramway Collision.—On Saturday two cars on the Clayton-le-Moors route came into collision in Whalley Road, Altham; both cars sustained damage, and the driver of one was seriously injured.

Bristol.—Tramway Purchase.—At a meeting of the City Council last week, the Tramways Option Committee reported the result of its negotiations with the Tramways Co., as to what rent or other sum the company would be willing to pay and what concessions it would be willing to make to the Corporation if the latter agreed to refrain from exercising its option of purchasing the undertaking for seven, 14, or 21 years. The Committee states that the company is unwilling to make any payment in the nature of a wayleave, or to make such adequate concessions in the way of revision of fares or otherwise as in the Committee's opinion it would be justified in recommending the Council to accept in consideration of the Corporation refraining to exercise its option. Having regard to existing circumstances, the Committee is not prepared to make any recommendation at present on the main point, viz., the advisability of the purchase of the tramways. It, therefore, had come to the conclusion that until the time for advising the Council arrives, it should be authorised from time to time as and when necessary to apply to the Board of Trade for any further order extending the purchase period.

The City Council has decided to apply to the Board of Trade to postpone the date for the purchase of the tramways.

Bury.—Female Labour.—For the first time locally, female conductors were at work last week on the Corporation cars.

Continental.—Italy.—The Camera di Commercio, of Genoa, has approved of a scheme for the electrification of the Genoa to Ovada Railway, at present worked by steam. The electrification is rendered necessary by the congestion of traffic from the Port of Genoa.

A motion has been presented in the Consiglio Provinciale, of Florence, declaring necessary the abolition of steam traction and the substitution therefor of electricity, on the railway lines Florence-Campi-Prato, Florence-Poggio a Caiano, and Casellina-Porto di Mezzo, as soon as the Provincial Deputation shall judge the moment opportune, and in view of the circumstances connected with the war.

Spain.—The engineers entrusted with the surveys for the direct electric railway from Madrid to Valencia have completed their work with the exception of that relating to the Madrid terminus.

Dundee.—On the suggestion of the Corporation tramway manager, the Corporation electricity department, which controls the overhead equipment of the tramways, has fixed up an automatic trolley reverser at the foot of Reform Street, and should the device work successfully, it will be adopted on the other parts of the system.

Glasgow.—Female Labour.—The tramways manager has reported verbally as to the results of the experiment of training as tramcar drivers, such of the women conductors as he considered suitable, and has been instructed to maintain the tramway service by the employment, if possible, of men as drivers, but if men cannot be obtained, then by the employment of women, on the same terms and conditions as the men.

London.—B. of T. Traffic Report.—A report on London traffic in 1915, by the B. of T., has been issued, which mentions that the results of the working of the L.C.C. tramways during the first four months of 1914-15 showed some improvement, which led to unjustified hopes of continued improvement. During 1914-15 the receipts amounted to £2,399,847, and working expenses to £1,700,571, leaving a surplus on working of £699,276, which, after deducting debt charges, left a deficiency of some £33,000. For the present year, 1915-16, it would appear probable that the general reserve fund will be absorbed by the deficit on revenue account, and may possibly fail to meet the whole deficiency. The strike of May last was estimated to result in a loss of £100,000, while increased wages and other expenditure will tend to add to abnormal costs.

The Highways Committee has considered the application of the Erith U.D.C. for a prov. order to run motor-'buses through the borough of Woolwich, and, if necessary, representations are to be made to the L.G.B. with a view to securing contributions towards road maintenance and street improvements, and an undertaking not to oppose an application by the L.C.C. for powers to run 'buses or tramways in Erith.

Mossley.—At a meeting of the T.C., on March 9th, reference was made to the increasing cost of carting coal from the railways to the gasworks—one speaker said the increase was from £700 to £1,400—and the suggestion was made that the tramways should be utilised for the conveyance of coal. It was estimated that a saving of £500 a year could be effected, and the matter had been brought to the notice of the manager of the Joint Electricity and Tramways Board, and was receiving consideration.

Newcastle.—Accident.—On the evening of the 9th inst. a collision occurred on the Scotswood tramway route; a double-decked bogie car, heavily laden, was going up the Delaval Bank towards the city, followed by a single-decked car, when the former suddenly stopped and ran backwards into the following car, causing considerable damage, but no personal injury. It was stated that the current was accidentally cut off from the first car, and the brakes failed to hold the car on the bank, owing to the greasy condition of the rails

Electric Vehicle.—The Town Improvement and Streets Committee has decided to purchase an electrically-driven van for the collection of domestic refuse.

Oldham.—At a recent meeting of the Tramways Committee, Ald. Isherwood disposed of various statements to the effect that something was wrong with the finances of the department. The borough treasurer had investigated the matter, and found all in order; in justice to the late manager, and to the Committee, and to the general public, that report should be made public.

South-Western Electrification.—On Sunday last the electrical train service over the loop line *viâ* Hounslow was commenced, and a new station opened at Barnes Bridge. The service is half-hourly, with extra steam trains at business hours.

Swansea.—Tramways Supply.—A draft agreement has been approved between the Swansea Tramways Co. and Corporation for the supply of the whole of the electrical energy for the working of the Swansea tramways. At present the Corporation supplies about one-fourth, and it is stated that the company is anxious to purchase the remainder of the current and proposed to scrap its present electricity station.

Walsall.—Year's Working.—The working of the tramways undertaking during the past 12 months has resulted in a surplus of £7,846. Working expenses during the period under review amounted to £22,955, an average of 7·530d. per car-mile, as against 7·267d. in 1914. The total income was £40,291, £39,351 of this sum being traffic revenue, or an average of 12·908d. per car-mile as compared with 11·094d. in 1914. This leaves a balance carried to net revenue account of £17,336, where interest and rent of leased lines are added, bringing the amount up to £18,615. Against this total is set interest, income-tax, sinking fund, and allowances to men serving in H.M. Forces, leaving a sum of £7,846 for appropriation. To this has been added the surplus on the motor-'bus undertaking (£928), making a total of £8,775, from which £2,000 will go in aid of the rates, £2,988 for the purchase of three additional 'buses, £899 for the purchase of a site for depôt extension, and £515 for a temporary garage. From the balance a further £2,000 is to go in aid of the rates, and £300 for a motor parcel-van. The remaining £72 will be carried forward.

TELEGRAPH and TELEPHONE NOTES.

Guernsey.—The accounts of the Guernsey States Telephone Department, for the year 1915, show that the receipts were £7,511, and the expenses (including £864 interest on capital, and £724 Post Office royalty) £4,741; sinking and reserve funds absorbed £2,230, leaving a net surplus of £540. For 1914 the profit was £769. Subscribers' lines (including extensions) numbered 2,071, an increase of 33, and the mileage of metallic circuits, overhead and underground, was 2,584 miles. Subscribers' and public calls amounted to 1,590,492. The capital expenditure on land, buildings, and works amounted to £50 358 (including £18,358 drawn from the reserve funds), of which £3,632 has been repaid.

Wireless in the R.N.A.S.—Boy mechanics are immediately required for training as wireless telegraphists in the Royal Naval Air Service; age between 17 and 17½ in March, 1916. Service is for the period of the war only. Application should be made to the Wireless Officer, R.N.A.S. Depôt, Barlby Road, North Kensington.—*The Times.*

Code Telegrams.—The Riverside Code, 5th Edition, has been added to the list of codes authorised for use in foreign telegrams. The code is not at present available for use in telegrams to the Argentine Republic, Brazil, Paraguay, Uruguay, and the Republic of Honduras.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Sydney.—May 1st. Two 300-kw. turbo-alternators, condensers, switchboard, &c., for the pumping station at Ryde, for the Metropolitan Board of Water Supply and Sewerage at Sydney.*

May 3rd. N.S.W. Railways and Tramways Department. One 2,500-kw. turbo-alternator, for Zara Street, Newcastle, power house. Specifications (20s.) from the Engineer's office, 61, Hunter Street, Sydney.*

Bristol.—March 24th. Unwashed small coal or washed pea coal for the Corporation electricity works. Mr. H. F. Proctor.

Dundalk.—March 21st. U.D.C. Engine-room stores, cables, lamps, &c, for the Electricity Department. See "Official Notices" February 25th.

Dundee.—March 29th. Corporation. Electrical stores, meters, &c. Electricity Department, Dudhope Crescent Road.

Halifax.—March 23rd. Electrical fittings for six months, for the B. of G. Mr. A. T. Longbotham, Clerk, 4, Carlton Street.

London.—March 24th. H.M. Commissioners of Works. Main switches, main fuses, switch fuses and fuseboards, for one year. See "Official Notices" to-day.

Manchester.—March 22nd. Electricity Committee. 6,600-volt three-phase switchgear, for Stuart Street station. See "Official Notices" March 10th.

New Zealand.—Dunedin.—May 17th. City Council. (1) Tramcar bodies; (2) electrical equipment. Plans, &c., from the Town Clerk, Dunedin.*

Wanganui.—May 9th. Borough Council. Gas producer plant, gas engine, generator and switchgear.*

Rathmines.—March 27th. U.D.C. Cable, house-service and fuse boxes, and meters, for 12 months. See "Official Notices" to-day.

Redditch.—March 28th. U.D.C. Three and six months' supply of coal for the Electricity Department (125 tons of D.S. nuts per week). See "Official Notices" to-day.

Spain.—March 27th. The municipal authorities of San Ildefonso (Province of Segovia). Tenders for the concession for the electric lighting of the town during a period of two years.

Warrington.—March 21st. Electrical goods (not of German or Austrian origin) for six months, for the B. of G. Mr. A. Bottomley, Clerk, Bewsey Chambers.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

Bradford.—The Tramways Committee has accepted the offer of the Dunlop Rubber Co. for rubber tires for railless trolley cars for two years from February, 1916, at 7·5d. per mile run per vehicle and that of the National Rail and Tramway Appliance Co. for brake blocks at an increase of 5 per cent. on the present contract.

Colchester.—T.C.:—

Electrical equipment of tramcars (for three months).—Mr. G. W. Allsop and P. R. Jackson & Co.
Overhead equipment (for three months).—B.I. & Helsby Cables, Ltd.
Rubber and fibre (for three months).—L. Andrews & Co.
Castings (for three months).—Stanford & Co.
Car fittings (for three months).—British Hele-Shaw Co. and Stanford & Co.
Oils and grease (for a year).—Williams & Co.

Glasgow.—The Tramway Works and Stores Committee recommends acceptance of the following tenders:—

Galvanised-steel wires.—J. Stewart & Co.
91/18 cab-tire cable.—St. Helens Cable Co.
Three-core cable.—B.I. & Helsby Cables, Ltd.

The Electricity Committee has accepted tenders for (1) air filters required in connection with the new turbo-alternators for the Port-Dundas and the St. Andrew's Cross generating stations, and (2) fans for the cooling towers at the St. Andrew's Cross station, as follows:—

Air filters.—Davidson & Co., Ltd., £562.
Fans.—Matthews & Yates, £727.

London.—Fulham.—The Electricity Committee recommends the acceptance of the tender of Messrs. Cory Bros. for the supply of 100 tons per week for six months of small Aberclyde Welsh coal, at 23s. 6d. per ton, and of the Battersea B.C. offer of 4,000 tons Pooley Hall small nuts, at 20s. 7d. per ton at Chelsea Basin, plus 1s. 2d. per ton for delivery alongside of the Council's wharf.

HAMMERSMITH.—The Electricity Committee has received the following tenders for annual supplies :—

BOX FRAMES, COVERS, BOXES, &c.

W. Lucy & Co., Ltd.	(recommended)	£446
Johnson & Phillips		585
B.I. & Helsby Cables, Ltd.		774
Siemens Bros. & Co., Ltd.		807

INSULATING BOX FILLING COMPOUND.

		Per cwt.
Dussek Bitumen Co.	(recommended)	£0 17 0
L. Andrews & Co.		1 0 0
Limmer Asphalte Paving Co., Ltd.		1 0 0
Premier Bitumen & Asphalte Co., Ltd.		1 5 0
Siemens Bros. & Co., Ltd.		1 5 6
Johnson & Phillips, Ltd.		1 10 0
B.I. & Helsby Cables, Ltd.		2 6 8
Callender's Cable & Construction Co., Ltd.		2 12 6

INSULATED WIRES.

General Electric Co., Ltd.	(recommended)	£175
Pirelli, Ltd.		175
Gillespie & Beales		195
Liverpool Electric Cable Co., Ltd.		200
A. F. Goodwin & Co.		207
Henley's Telegraph Works Co., Ltd.		219
B.I. & Helsby Cables, Ltd.		221
Siemens Bros. & Co., Ltd.		222
Johnson & Phillips, Ltd.		242
Callender's Cable & Construction Co., Ltd.		222
W. T. Glover & Co., Ltd.		222

The Committee recommended the acceptance of the following tenders :—

Steam packing and jointing materials.—Middleton Bros.
Fire bricks, clay and lime.—Albion Clay Co., Ltd.
Electrical accessories.—Baxter & Caunter, Ltd.

Swansea.—Electric lighting of two new elementary day schools—Brynmill and Cwmburla. The tender of Mr. J. W. Law, the lowest in each case, was accepted by the E.C., at £168 and £410 respectively.

Whitehaven.—Council. For a year :—

Cylinder and crank-chamber oil.—Vacuum Oil Co., Ltd.
Tapes.—W. T. Henley's Telegraph Works Co., Ltd.
Bitumen.—Dussek Bitumen Co.

Wolverhampton.—The Electricity Committee recommends the acceptance of the tender of Messrs. Bruce Peebles and Co., Ltd., for a 750-KW. converter.

FORTHCOMING EVENTS.

Institution of Mechanical Engineers.—Friday, March 17th. At 6 p.m. At the Institution of Civil Engineers, Great George Street, S.W. Paper on "The Composition of the Exhaust from Liquid-fuel Engines," by Second-Lieut. R. W. Fenning, R.E. (T).

Greenock Electrical Society.—Friday, March 17th. At 7.45 p.m. At the Temperance Institute, 19, West Stewart Street. Papers on "Some D.C. Diagrams of Connections," by Mr. D. Angus, and "Heating and Ventilation," by Mr. W. A. Toppin.
Friday, March 24th. At the Temperance Institute, 19, West Stewart Street. General meeting.

Electro-Harmonic Society.—Friday, March 17th. At 8 p.m. At Holborn Restaurant. Smoking concert.

Royal Institution of Great Britain.—Saturdays, March 18th and 25th. At 3 p.m. At Albemarle Street, W. Lectures (II and III) on "Radiations from Atoms and Electrons," by Prof. Sir J. J. Thomson.
Thursday, March 23rd. At 3 p.m. At Albemarle Street, W. Lecture (II) on "Organic Chemistry in War : Organic Products used as Propulsive and Explosive Agents," by Prof. H. E. Armstrong, F.R.S.

Institution of Electrical Engineers (Manchester Local Section).—Tuesday, March 21st. At 7.30 p.m. At the Engineers' Club, 17, Albert Square. Paper on "The use of Continuous Current for Terminal and Trunk Line Electrification," by Mr. N. W. Storer.

Illuminating Engineering Society.—Tuesday, March 21st. At 5 p.m. At the Royal Society of Arts, 18, John Street, Adelphi. Discussion on "Some Aspects of the Design and Use of Glassware in relation to Natural and Artificial Illumination."

North-East Coast Institution of Engineers and Shipbuilders.—Friday, March 24th. At 7.30 p.m. At Bolbec Hall, Newcastle-on-Tyne. General meeting.

Physical Society of London.—Friday, March 24th. At 5 p.m. At the Imperial College of Science, South Kensington, S.W. General meeting.

Manchester Association of Engineers.—Saturday, March 25th. At the Grand Hotel, Aytoun Street. Report of the Tool Steel Research Committee.

NOTES.

Electro-Harmonic Society.—The last smoking concert of the present season will be held at the Holborn Restaurant (King's Hall), to-night, Friday, commencing at 8 p.m. ; Mr. J. H. Rider will be in the chair. The artistes will be as follows :—Mr. Maurice D'Oisly, tenor ; Mr. Edward Beaumont, baritone ; Mr. Fraser Gange, bass-baritone ; Mr. Joseph Bull, banjoist ; Mr. Foden Williams, humorist ; Mr. Allan Stainer, conjuror and ventriloquist ; Mr. Thornley Dodge, entertainer ; and Mr. Bernard Flanders, A.R.A.M., solo pianoforte and accompanist.

Work Wanted.—The repair staff of Taunton electricity works wants to fill in spare time with lathe, drilling machine or vice work. An announcement on the matter appears among our advertisements to-day.

Inquiries.—Makers of zinc cases for dry cells, and of insulating links for use in tumbler switches, are asked for.

Committal Order.—In the King's Bench Division, before Mr. Justice Horridge, Mr. Barton-Wright, of the Bartitan Institute, Oxford Street, appeared to show cause why an order for committal should not be made against him for having failed to obey an order of Mr. Justice Scrutton, made in January last, directing him to pay £12 a month in liquidation of the amount of a judgment obtained against him by Mrs. Beattie, a patient.

His Lordship made an order for committal, but directed that it should not issue if Mr. Barton-Wright paid £6 in a fortnight and the balance in a month.

Institution and Lecture Notes.—Institution of Electrical Engineers.—At a largely attended general meeting of the DUBLIN LOCAL SECTION, at the Royal College of Science, Dublin, on Friday last, the following resolutions were passed :—

1. That this meeting is of opinion that the membership of this Institution of any citizen, born of alien enemy parentage, naturalised or not naturalised, shall forthwith cease, and that after the termination of the war no such citizen shall be eligible for membership ; and further, that any citizen of the Empire or allied or neutral nations, being a member of any grade of the Institution, who becomes an agent for a firm owned or controlled by citizens of those enemy nations shall automatically cease to be a member.

2. That the chairman, hon. secretary and another be deputed to attend the general meeting to be held in London to support the terms of the foregoing resolution.

At the meeting of the SCOTTISH LOCAL SECTION at Glasgow, on Tuesday last, Dr. Charles Chree delivered his Kelvin lecture on "Terrestrial Magnetism."

At a meeting of the NEWCASTLE LOCAL SECTION, on Monday, Mr. J. S. Peck read an abstract of a paper by Mr. N. W. Storer, on "The Use of Continuous Current for Terminal and Trunk-Line Electrification."

Birmingham and District Electric Club.—A "ladies' night" was held on Saturday, when a lecture was delivered by the President (Mr. W. G. L. Riddle) on "Impressions of China and the Chinese." A musical programme followed.

Croydon Wireless Society.—At the meeting on March 4th, Mr. E. H. Pollett, B.Sc., gave a lecture and demonstration on electric welding.

Engineering and Scientific Association of Ireland.—"Small Electric Stations" was the subject of a lecture delivered by Mr. L. J. Lawless last Monday at a meeting of the Association. Various small electric schemes in Ireland were described, and it was shown that whether they were operated in competition with, or in substitution for, gas they proved profitable.

"Lest We Forget."—The report of Lieut.-Col. Von Donop, the Board of Trade Inspector, on the disaster near St. Bede's Junction, on the North-Eastern Railway, on December 17th, 1915, was issued last week. The Inspector says :—"This accident is one which the provision of track circuit, which is now being so largely adopted by railway companies, would undoubtedly have prevented." He adds that the evidence that the fire which consumed the wreckage originated with gas is more definite than in any previous case, and furnishes a very conclusive object lesson as to the additional danger which is caused in the case of an accident by the presence of gas on the train. After each of the Hawes Junction, Ditton, and Aisgill accidents, the Board of Trade specially communicated with all the companies on the desirability of electricity as an illuminant in preference to gas. On December 31st, out of a total number of 4,241 coaches owned or maintained by the North-Eastern Railway, 626 were lighted by electricity. But the company has not undertaken, as several other companies have done, that all their new stock shall be so fitted, nor have any steps been taken by them towards the conversion of the existing gas-lit stock.

The Inspector expresses the hope that this fire may lead the company to the adoption of a definite decision in favour of electric lighting for all new stock, and for the gradual conversion of the gas-lit stock.

Electric Cooking Development in a Small Town.—A recent issue of the *Electrical World* contained some details of the method adopted for introducing electric cooking at Glendive, Mont., which has a population of 4,000. In view of the increased revenue if electric cooking were adopted, it was considered worth while to offer ranges at cost to induce consumers to try them. It was further decided to furnish wiring free, putting in stoves on a 30 days' free trial, but with a charge of $4 in case the consumer returned the stove. The charge for energy is 4 cents per KW.-hour, with a dollar minimum charge per month, and no meter is installed until the end of the trial period, because experience shows that the first month's bill being the largest will tend to prejudice the consumer against electric cooking. It is found that the average consumption per month per range is 100 KW.-hours. In a few months 60 ranges were sold on this basis, and it is hoped to have 150 in use before 1917. It is also noted that the peak load increase has been small—not over 25 KW.

Waste Copper Recovery by Electricity in Russia.—The All-Russia Town and Communal Union is organising a factory for using waste copper. Statements have been prepared of the stocks of waste copper on the railways and in the Government works, and shortly, says a Petrograd paper, work will be begun on the recovery of such copper by the use of electricity.

The Metric System.—The annual report of the Chief Inspector of Weights and Measures shows that last year the number of metric weights and measures verified in Whitecross Street was no less than 33,000, whereas in 1914 the total stood at only 1,741.

Waste of Coal.—Last week Prof. W. A. Bone, Professor of Chemical Technology at the Imperial College of Science, delivered an address on the subject of economy in the consumption of fuel to the members of the Society of Chemical Industry. He stated that the coal which was left behind in the pits represented about 25 per cent. of the coal raised, and the question of checking this wastage was one of supreme national importance. By the reimposition of the duty of 1s. a ton on all coal exported from this country a revenue of about £5,000,000 would be produced, which might be earmarked by the Government for investigation of the problem of coal fuel economy. The waste in the domestic consumption of coal was notorious, and it was the duty of the leaders of science in this country, in the interests of the nation, to see that the Government should not be allowed any longer to overlook a matter of such vital importance. By the elimination of wasteful processes in iron and steel works and rolling mills, a saving of about two-thirds of the fuel consumption might be effected, and the present unsatisfactory situation in the coking industry should be remedied.

Volunteer Notes.—Engineering Institutions' V.E.C.—Orders for week commencing March 20th, 1916.—By Lieut.-Col. C. B. Clay, V.D., Commanding.

Drills, 6.25 to 7.25; 7.25 to 8.25 p.m.

Monday, March 20th.—Sections 1 and 2, Technical; Sections 3 and 4, Lashings and Trestle Bridging, Signalling Class and Recruits.

Tuesday, March 21st.—School of Arms, 6 to 7 p.m.

Thursday, March 23rd.—Shooting for Sections 1 and 2, and Signalling Class.

Friday, March 24th.—Sections 3 and 4, Technical; Sections 1 and 2, Lashings and Trestle Bridging; Signalling Class and Recruits.

Saturday, March 25th.—Uniform Parade at 2.45 p.m.

Attendance is specially desired for all Members on Saturday, March 25th, as it is proposed to hold Battalion Drill.

E. G. Fleming,
Company Commander and Acting Adjutant.

3rd Batt. (Old Boys) Central London Volunteer Regiment.—Battalion Orders by Capt. R. J. C. Eastwood (Commandant), Thursday, March 16th, 1916:—

Battalion Parades.—Saturday, 18th inst.—The Battalion will Parade, as strong as possible, outside Putney Bridge Station, at 3 p.m., and proceed by march route through Richmond Park, and back to Putney Bridge Station, dismissing about 5.30 p.m.

Dress.—Marching Order. Members may use their own discretion as to what they carry in their rucksacks, but the total weight of the articles carried must not be less than 20 lb. "Derby" Recruits are invited to attend.

Sunday, 19th inst.—The Battalion will parade, as strong as possible, at Liverpool Street Station (low-level entrance, G.E.R.) at 9.30 a.m., and proceed by train for Entrenching duties. Members will carry their own lunch. The Battalion will return to town about 6 p.m.

Musketry.—Acton Range will be open for shooting on Saturday, the 18th inst. Members desirous of shooting must send in their names to the Musketry Staff. Parade in uniform punctually at 2 p.m. Members are requested to bring their own ammunition, if possible.

There will also be shooting at Bisley. Members should report themselves to Sergeant Cotter, at the barrier of No. 6 Platform, at 12.45 p.m., on Saturday next, the 18th inst.

A. G. Joiner, *Major and Adjutant*, O.B.C.

Electricity at the Front.—An article in *l'Industrie Electrique*, quoting from the *Elek. Anzeiger*, states that the territory in Belgium and France which is occupied by the enemy is very rich in factories, with a great many central stations supplying electric light and power. In the villages even the poorest houses are provided with the electric light. Many manufactories have been damaged or completely destroyed by artillery fire, but, with much labour and skill, some of them have been repaired and set in operation again. The high-pressure mains, the transformer stations, and distributing networks have suffered still more than the works from the effects of the fighting, but as soon as possible after the district is occupied the mains are put in order, and the electric light is brought into use, a very important matter, in view of the scarcity and high price of oil and candles. As there were stocks of coal at the pit-heads, and the pits that were in good condition have been restarted by the Germans, energy is generated at very cheap rates. Even before the large power stations had been restored, ingenious soldiers had brought many small installations into use for lighting houses, and the electric light is almost indispensable for hospitals, operating theatres and dressing rooms, bakeries, railway stations, and offices.

With the aid of electric power the Germans have been able to thrash quickly considerable quantities of corn, to drive their workshops, and to carry on a variety of important services. As coal cannot be used at the mines in the neighbourhood of hostile artillery for fear of attracting attention by the smoke, winding engines have been driven by electric power. In the stables chaff-cutters have been driven by motors, and the dentists in rear of the front use motors to ply their art. In some cases, places which before the war were not electrically lighted have been provided with installations.

The use of electricity at the extreme front line is particularly important. In spite of the difficulty of laying mains to the firing line, electric pumps are often used to clear the trenches of water; electricity has also proved most useful in tunnelling for mines quickly and silently, a matter of great importance, besides making it possible to ventilate long and narrow underground galleries. Electric light is also used in the trenches and dug-outs. It is stated, in illustration of the wide use of electricity, that in 22 localities about 4,500 lamps have been installed, as well as 105 motors, of a total of 450 H.P.

Our French contemporary adds the amusing comment that the German journal did not mention (what it knew) that on restarting the power station at Lille, at the commencement of the German occupation, the electricians in charge took three months to find out that they were supplying free light and power to certain towns which were still in the hands of the allied armies, by way of the underground cables which connected the station with various sub-stations. Thus, for example, the British at Armentières for that period obtained their electric light from the Germans. And many other interesting matters will be revealed by *l'Industrie*—after the war.

Electric Vehicle Association of America.—A special meeting of this Association was to be held last week, with a view to members voting on the proposal that the Association should be affiliated with the National Electric Light Association, as its Electric Vehicle Section. Under this arrangement the E.V.A. annual convention would become one of the N.E.L.A. section sessions.

Trade with Spain after the War.—According to information furnished by H.M. Consul at Bilbao, local business men anticipate that after the war there will be a rush of Germans to Spain intent on doing business in, and trading with, that country. German firms will be less disliked in Spain than they are in countries with which Germany is at war, and they will, doubtless, be eager to regain and make the most of their Spanish business connections. Before the war Spain was flooded with cheap German goods, and it is reported that 75 per cent. of the machinery, tools, electrical fittings, &c., in use in Bilbao is of German manufacture. Many of these goods are highly finished, but very poor in quality; nevertheless, they are preferred by the Spanish purchaser on account of their cheapness. The present is, however, considered a good moment for introducing United Kingdom manufactures. H.M. Consul, therefore, suggests to United Kingdom firms, if they wish to preserve their position in Spain, they should consolidate their connections and clientèle, so as to be able to compete against the expected German business effort. Large numbers of Germans are now in Spain employed in obtaining information on every kind of subject.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—After a very lengthy discussion, the Blackburn Council has approved of a recommendation of the Electricity and Tramways Committee to increase the salary of Mr. P. P. Wheelwright, the electrical engineer, from £700 to £800. An amendment referring the matter back was defeated by 25 votes to 22.

The Bristol Electrical Committee reports having considered the desirability of granting Mr. Robt. Parker, foreman of the generating station, a gratuity in respect of his long service, but is unable to agree as to the making of any grant.

The Swansea Corporation Electricity Committee has decided that Mr. H. A. Davies, of the public lighting section, be placed in charge of the new publicity department, and that he be raised to Scale "B" in the salary scale.

The Dublin Corporation, by 36 votes to 9, adopted a report of the Electricity Supply Committee recommending an improvement in the scale of remuneration of the meter readers; and that Mr. Wm. Dillon, of the accountant's section of the and that Mr. Wm. Dillon, of the accountant's section of the secretarial staff, be appointed a first-class officer.

General.—On the 6th inst., at the Woolwich Works of Messrs. Siemens Bros. & Co., Ltd., was celebrated the completion of 50 years' service in the employment of the company by Mr. Robert Bertram, of the dispatching and receiving department. Mr. Alexander Siemens congratulated Mr. Bertram on having attained his jubilee of service, during which

time he had seen the business grow from a very small beginning, when about 50 persons comprised the whole staff, to the present time, when the number of the employés is about 4,000. He had the pleasure of presenting him with an illuminated address and a cheque from his colleagues at the works, as a token of their esteem and regard, and also a cheque on behalf of the company as a recognition of his faithful service and the manner in which his duties had always been performed. Mr. Bertram, in reply, thanked the company through Mr. Siemens, and also his colleagues, most of whom were present, for their gifts and the expression of their goodwill, and referred to some of his very early experiences when the neighbourhood of the works was still rural.

Sir George Greenhill, F.R.S., and Mr. Charles Bright, F.R.S.E., M.Inst.C.E., have requested that their names be withdrawn from the executive committee of the Aeronautical Institute.

Mr. W. A. Scott, works manager of Messrs. Bruce Peebles and Co., Ltd., Edinburgh, was married on 9th inst. to Alexandrina, second daughter of Alexander Mann, Edinburgh. A few days prior to the wedding Mr. Scott was presented with a canteen of cutlery and a silver cigarette case by the workmen and staff.

The marriage took place at St. Robert's Catholic Church, Harrogate, on March 4th, of Mr. A. C. Cooper, electrical engineer, of Manchester, and Miss Muriel Margaret Seamer.

Roll of Honour.—The *Times* records that Second-Lieutenant H. A. Johnston, of the Royal Flying Corps, was killed in France on March 4th, aged 24. Before volunteering as a private he was with Messrs. Siemens Bros., and had fitted wireless installations in many parts of the world.

Obituary.—Mr. C. W. Fairweather.—We regret to record the death of Mr. C. W. Fairweather, consulting engineer, of Newcastle-on-Tyne, who was one of the founders and managers of the Northern Counties Electric Supply Co., which, after a very successful career, was absorbed by the Newcastle-upon-Tyne Electric Supply Co. Mr. Fairweather was well known in engineering and electrical circles, and in later years carried on an extensive consulting practice in connection with mining and collieries. His death will be deplored by a very wide circle of friends.

Mr. B. Short.—Mr. Bert Short, who was for six years chief clerk and cashier at the North Metropolitan Electric Supply Co.'s undertaking at St. Albans, passed away on March 4th, after an operation at St. Bartholomew's Hospital.

NEW COMPANIES REGISTERED.

New Era Signs (U.S.A.), 1916, Ltd. (142,233).—This company was registered on March 8th, with a capital of £200 in 1s. shares, to acquire and develop the patent rights in the U.S.A. of an invention for improvements in or relating to flashlight advertising devices, to carry on the business of manufacturers of and dealers in advertising apparatus for displaying electric and other advertisements, dynamos, lamps, wires, cables, insulating materials, accumulators, telephone and other apparatus, &c., and to adopt an agreement with E. C. Leachman and the Magna Charta Publishing Co., Ltd. The subscribers (with one share each) are: E. C. Leachman, 9, Oakley Street, Chelsea, S.W., advertising expert; T. C. Elliot-Lawson, 56, Cleveland Square, W., company director. Private company. The number of directors is not to be less than two or more than seven; the first are T. C. Eliott-Lawson, F. Hope-Jones, E. C. Leachman, and C. H. R. Profumo. Registered office: Albion House, 59-61, New Oxford Street, W.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Lancashire Light Railways Co., Ltd.—A memorandum of satisfaction in full on June 9th, 1915, of a mortgage or charge dated June 29th, 1907, securing £6,000, and a mortgage or charge dated January 1st, 1908, being a transfer of the said mortgage or charge, and a further charge securing £3,000, has been filed.

Reid Brothers Engineers, Ltd.—Particulars of £3,000 debentures, created February 17th, 1916, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Faringdon Electric Light and Power Co., Ltd.—Issue on May 15th, 1914, of £300 (as collateral security with bankers for loan), and on February 11th, 1916, of £1,100 debentures, parts of a series of which particulars have already been filed.

Bourton-on-the-Water Electric Light and Power Co., Ltd.—Issues on various dates from October 15th, 1913, to February 11th, 1916, of £250 debentures, parts of a series of which particulars have already been filed.

CITY NOTES.

County of London Electric Supply Co., Ltd.

Mr. H. B. Renwick presided at the annual meeting, held on Monday. He said that the gross receipts had grown by 9 per cent. to £298,269, but the costs and expenses had increased by £28,592, or 20.6 per cent., and the net revenue was £159,639, as compared with £161,043 for 1914. Increased costs due to the war occurred in the items for coal and other fuel, salaries and wages, rates and taxes, and insurance. Had it not been for war burdens, the company would have had a record year in all respects. Coal had been about 50 per cent. above the 1914 prices. Their normal supplies were sea-borne, and the cost of freightage alone was now more than the cost in pre-war times of the coal itself delivered into the bunkers. They still had difficulty in maintaining proper stocks of coal. It was time some public action was taken to deal with the matter on lines similar to the recent Act determining the maximum price of coal at the pit's mouth or by constituting a Board of Control with similar duties to those of the Railway Executive Committee which was now doing such good work in regulating the traffic of the British railways. There was a general increase in practically everything purchased during the year. The gross effect of their war burdens was to more than nullify the very excellent increase in the gross receipts. In order partially to recoup the company for these additional expenses, the charges to consumers had been advanced by 10 per cent. In the capital expenditure of the year (£59,105), £31,745 represented expenditure on mains, which included the outlay necessary to give supply in bulk to the districts of Sutton, Carshalton, Wallington, and Cheam, and in the district under the Romford Order. In regard to growth of business, the position was more than gratifying. The number of units sold increased by 2,549,309, and the consumers were 25,913, against 24,212. The continued expansion during war, in face of lighting restrictions and other adverse influences, was a striking testimony to the vitality of the company's business and to the potentialities of its areas of supply. It also spoke well for their commercial and business-getting staff, who had secured that large increase although working with a depleted staff and under adverse circumstances. They had also secured during the year two long-term contracts for supply in bulk—one with the South Metropolitan Electric Tramways & Lighting Co. in respect of their Sutton districts, and the other with a company in respect of Banstead, Chipstead, and Walton-on-the-Hill. Supply had already been commenced in the Sutton districts, but in the other cases operations would probably be deferred until after the war. These contracts had a significance and importance far beyond their revenue-producing value, seeing that they carried matters a step further in the direction of unification of supply, and they were in keeping with the company's policy of linking-up and centralisation. They adopted that policy at the commencement of operations 22 years ago, and after years of labour that policy was being vindicated more and more as time proceeded. A further result of these contracts was that there was now one generating station less in the London district, for the Sutton station was being scrapped, and the necessity was avoided of erecting a further station which would otherwise have been required for the Banstead district. They were quietly doing what they could toward solving the bigger question of the London electricity supply problem. During the year they commenced supply in Romford. They now served a total area of about 223 square miles, of which about 183 were distributing and about 40 bulk supply. After alluding to the Bournemouth and Coatbridge associated companies, Mr. Renwick said that the South London Electric Supply Co., in which they had a large share interest, had well maintained its position. The County Co. and its associated companies had 303 men on active service. In regard to the prospects, applications received to the end of February amounted to an additional 1,125 kw., which exceeded the previous year's figures; the units output was up by 10 per cent., and there were 60 per cent. more new consumers. So far as new business was concerned, therefore, they could look forward with some measure of confidence, but they must expect further increases in station costs and other burdens in the way of war taxes. The chairman concluded by referring to the special services rendered by Mr. C. P. Sparks, the engineer-in-chief, in connection with the coal and other difficulties, and by Mr. F. C. McQuown, the secretary, to whom the period had been one of unusual strain.

Pará Electric Railways & Lighting Co., Ltd.

The annual meeting was held on February 28th, Mr. Follett Holt presiding. The chairman said they had suffered from a reduction in gross receipts, resulting from the continuance of the financial crisis in Brazil; measured in sterling, with exchange at 16d., the loss in receipts amounted to £6,408, or only 2¼ per cent. on the previous year's figures, the principal cause being a decrease of 957,000 in the number of tramway passengers carried. This reduction had been met by a reduction of 13 per cent., or over £17,000, in working expenses, by employing wood fuel in place of imported coal for power production, and by a very strict supervision of all items of expenditure. The fall in exchange during the past year had not only swallowed up their increased earnings of over £10,000, but a further £23,000 besides. After placing £15,000 to reserve, which now reached the substantial sum of £96,545, they were able to pay a dividend of 5 per cent. on the ordinary shares. During the year arrangements for taking over the whole of the share capital of the Pará Gas Co., Ltd., were completed. They were now engaged in developing the sale of gas for cooking and industrial heating. Their prosperity depended to a great extent upon the amount of rubber collected on the Amazon and upon its export value, and 33,500 tons of rubber were exported between July, 1914, and June, 1915, at a price 26 per cent. better than last year; they need not be disturbed at present about the future of the trade of Pará.—*Financial Times.*

Kensington & Knightsbridge Electric Lighting Co., Ltd.

At the annual meeting, on March 2nd, Col. R. E. Crompton, who presided, said there had been still more stringent reductions in lighting, and private economies, which had resulted in a further reduction of 9 per cent. in the output. The total reduction for the two years 1914 and 1915 amounted to nearly 1,000,000 units. Against this the average price received per unit had only increased by 2 per cent. Owing to the rapid rise in the price of Welsh coal, the company's local works were closed, and the whole of the supply was taken from the Wood Lane works. A saving of about 15 per cent. had been made on repairs to plant, and the total working expenses had been cut down from £51,523 last year to £48,852 this year. The present value of the plant, not taking any credit for the increase in the value of the copper in the mains, was in excess of the value at which it stood in the books, and under the circumstances, as a temporary measure during the period of the war, the balance of the amount placed to the credit of the renewal fund had been reduced from £9,745 to £7,261. The total renewal fund credit stood at £139,021. The directors had contested the quinquennial assessment of the property by the Borough authorities of Westminster and Kensington, and had been successful in obtaining a considerable reduction. About one-quarter of the staff and workmen had joined H.M. Forces, and several others would have to join later. The total sum for rates and taxes paid during the past year had been increased by £816. The reduction of dividend had been smaller than that of other companies, although they had only increased their price by 2 per cent. to the public. The use of electricity for heating and cooking was steadily increasing. The chairman called the attention of the shareholders to the devoted work of Mr. Miller, who was not only the engineer, but performed the duties of managing director and had supreme charge of the Wood Lane works; the excellent position in which the company stood was due to him. Replying to questions, he stated that he personally had found that it was a great economy to use electric heaters instead of fires, and the Managing Director said they had had in the past year the largest increase in heating that they had ever had.

Oxford Electric Co., Ltd.

The annual meeting was held on Tuesday last week; Sir Henry Mance occupied the chair, and the Secretary read a memorandum stating that the revenue account showed a profit (including £1,055 brought forward) of £13,340. After providing £2,016 for debenture and other interest, also writing off £686 on account of hire-purchase installations, the balance available was £10,639. Renewals to the Diesel engine cost nearly £600, services to new customers £753, extensions of mains £483, meters £338. They had written off from the capital account a sum of £2,465, and had received during the year the sum of £5,000. being the first issue of 1,000 shares of the new preference capital created in 1914. The expenditure upon fuel had exceeded that of the previous year by over £800. Sales by meter showed a reduction of £1,184, and the revenue from street lighting was also less. The reserve and renewal of plant account, with the addition of the sum of £1,000 proposed to be now appropriated, would amount to £20,757. The chairman said that the expenditure on hire-purchase installations would be temporarily suspended. Of the clerical staff, four out of five were now serving with the Colours, and of the engineering staff, three members were called upon to serve at the commencement of the war, and 13 others joined shortly afterwards.

City of London Electric Lighting Co., Ltd.

The capital expenditure during 1915 was £25,952. The amount written off in respect of buildings, plant, and other works dismantled during 1915 is £30,738. Enforced reduction of lighting, and increased coal and production costs have prejudiced the annual profit. The total revenue was £311,820. After deducting expenses of generation and distribution repairs and maintenance, street lighting expenses, rent, rates, taxes, &c., amounting together to £161,060, £150,760 remains, plus £23,372 brought forward. Interest on loan, consumers' deposits, debenture interest, and other charges are deducted, and £50,000 is transferred to reserve, leaving £87,770. After paying 6 per cent. on the preference shares and 8 per cent. on the ordinary, as against 9 per cent. for 1914, £18,024 remains to be carried forward. The gross revenue was (as above) £311,820, as compared with £306,084 in 1914 (increase £5,735). The net revenue was £150,759, as against £164,464, a decrease of £13,705. The average price obtained per unit was 2.27d., as against 2.26d. in 1914. The consumers connected decreased by 370 to 14,720, and the kw. connected (including power and heating) increased by 629 kw. to 46,161 kw. The reduction in number of consumers is entirely due to war conditions causing the suspension of many businesses, notably among stockbrokers and foreign importing agents. The units generated increased from 33,906,963 to 34,643,297; and the number sold from 29,182,165 to 29,479,079; the maximum supply demanded decreased from 19,739 kw. to 17,424 kw. The units sold increased by 296,914, notwithstanding that the consumption for lighting purposes was more than a million units less. Power and heating supplies continue to show a steady increase; in 1915, 12,375,577 units were sold for power and 2,844,636 for heating, together being equal to 53 per cent. of the total units sold for private supply. 168 members of the staff are serving with the Forces. Four have been killed and nine wounded. Liberal allowances have been made to all, to ensure that no financial hardship shall be suffered, and all who return will be reinstated after the war. The Marquess of Winchester, one of the directors, is now serving in France. Annual meeting: March 22nd.

Newcastle-upon-Tyne Electric Supply Co., Ltd.

The connections to the system during 1915 were increased by 26,965 h.p., making 258,390 h.p. total. The profit for the year was £204,418, as compared with £178,380, plus £5,946 brought forward. Interest and debenture stocks, loans, &c., amounted to £58,696, leaving £151,669. After paying 5 per cent. on the preference and 6 per cent. on the ordinary shares, as compared to 5½ per cent. for 1914, placing £25,000 to depreciation reserve (as compared with £20,000), and £28,000 to general reserve (as compared with £17,000), £5,191 remains to be carried forward. £93,965 has been spent out of revenue on the efficient maintenance of the plant and system generally. £110,079 spent on capital account during the year represents further cost of extensions in progress at the Carville and Dunston power stations, and to the general distribution system. The nominal value of the shares held in the County of Durham Electrical Power Distribution Co., Ltd., has been adjusted to correspond with the reduced share capital of that company. Mr. R. P. Sloan has been elected to the board, but he retains his position as manager. At Dr. J. T. Merz's wish he has relinquished the position of chairman, and Mr. J. H. Armstrong has been elected to act in his place. Dr. Merz becomes vice-chairman. Annual meeting: March 21st.

Waste Heat and Gas Electrical Generating Stations, Ltd.

Mr. R. S. Newall presided at the annual meeting on March 8th in the absence of Dr. J. B. Simpson, whose speech he read. The capital expenditure had been increased by £3,654. The expenditure incurred was almost entirely in connection with the extensions at Weardale and Grangetown power stations. The new plant was being installed at Weardale with a view to a more efficient use of the gas received from the coke ovens, and the further plant at Grangetown was being put in with a view of maintaining a greater and more continuous output. Although the manufacture of the plant and the completion of the works must necessarily be slower than in normal times, there was a good prospect that all the plant would be brought into operation during the current year. These extensions would cost about £45,000. In June, 1915, the company had been allotted £10,000 of the 4½ per cent. War Loan, and the whole had been paid up. The general reserve and depreciation account had been increased by £11,000, together with £6,573 added for redemption funds in respect of plant supplied on hire-purchase terms. He had been asked by more than one shareholder whether they made proper reserves against possible industrial developments which might tend to supersede the methods they employed in the utilisation of waste heat and gas. He thought the accounts presented to them each year, and the explanations he had given at their meetings, showed that their reserves were ample; in fact, they made such reserves as would provide for the whole cost of their installations over the period for which they had contracted to receive the supplies of waste heat. The possibility of utilising waste heat in a more efficient way also received their continual consideration, and he had already referred to the new plant which was being installed at Weardale power station with that object in view. The profits earned during the year showed an increase of about £817 over the previous year. The amount of waste heat, gas, and steam that they received during the year had been considerably less, owing to the conditions arising out of the war, the reduction representing about 10 per cent. compared with 1914, and 15 per cent. as compared with 1913. The reduced quantity of waste heat available was largely in respect of those stations where they received exhaust steam from the blowing engines at blast furnaces, owing to the furnaces having had to be worked with different and varying classes of ore. Some of the coke-oven plants, also, had not been working at full capacity, but there was an improvement in this direction. Although the revenue had in consequence fallen, so far as it was derived from the output of electrical energy from the stations, there was some satisfaction in knowing that the supplies they had been able to give to the power companies had been of even greater advantage to them than in normal times, as, without the supplies of electrical energy derived from waste heat they would have been subject to largely increased costs owing to the higher price of coal. Referring to the excess profits duty, he said from estimates prepared he did not think they would be called to pay any appreciable amount.

Bruce Peebles & Co., Ltd.

At the annual meeting at Edinburgh, on Friday last, the Chairman, Mr. F. E. Andrews, said that they had considerably re-arranged the works and added to the buildings and machinery in order to expedite and increase the output. Their export trade, to which, ever since the company was formed, they had given unremitting attention, and to which they attached the highest importance, had naturally for the time being to give place to the more pressing demands

at home; but far from relaxing their efforts to keep closely in touch with all their foreign markets, they were increasing such efforts, and had already joined hands with several other well-known firms in forming a company to push business in Russia, so that at the conclusion of hostilities they would be in an advantageous position to deal with the large field for electrical engineering work which existed there. As regarded electrical machinery, they were constantly overhauling and improving their designs; their speciality, the Peebles-La Cour converter, continued to gain in favour; a great many had been supplied during the year, and they had a large number on order at the present moment. The profit from manufacturing and trading amounted to £13,945, compared with £11,649 for the year 1914. To this must be added interest and transfer fees £971, as against £619 last year, giving a total profit for the year of £14,916. There was a net profit of £7,096, as compared with £3,892 a year ago. This sum of £7,096 went to reduce the adverse balance against profit and loss account, which would now only amount to £10,686, and would, he hoped, be entirely eliminated in the course of another year. Their cash position had now for some time been entirely satisfactory. They had spent £4,660 during the year on maintenance out of revenue. Upwards of 34 per cent. of their workpeople had joined his Majesty's Forces, a large number of the staff were also serving, and practically all others of military age duly presented themselves for attestation under Lord Derby's scheme. They had to mourn the loss, among others, of Capt. W. Russell, a most valued member of their staff, and Capt. John Peebles, a son of the founder of the works and secretary of the company for many years. He could not speak too highly of the excellent work of the managers, Mr. Bastow and Mr. Bunting, of the staff, and of all their workpeople. Their financial position had steadily improved and might now be considered quite satisfactory. Sir John Cowan, of Edinburgh, was elected to a seat on the board of the company.

Mersey Railway Co.

Mr. J. Falconer, M.P., presiding at the annual meeting, said that having regard to the difficult times, and that they had no goods traffic, the increase of £5,860 in the receipts must be considered satisfactory. The increase in expenditure was £5,125, due partly to higher cost of coal and labour. The bulk of the increased labour cost was borne by the Government, as was also the whole of the increased cost of stores and materials. The net revenue was £52,860, as against £52,125 in 1914. Since they had been working the line electrically they had put £2,000 a year regularly to the renewal fund, and they had said that when the sum reached £20,000 they would reconsider their position. It had now reached £22,066, and they had reduced the allocation from £2,000 to £1,000. They had now begun the payment of interest on the last of the debenture stocks, and when the full interest on that was completed they would be in a position to commence paying something to the preference shareholders. In reply to questions, Mr. Falconer said that local traffic had shown satisfactory development, more than maintaining the ratio of progress of past years. There had been practically a stoppage in the development of the country around the railway because nobody was undertaking building operations when building cost 30 to 40 per cent. above the normal. He did not know who would get the best of the bargain in the financial arrangement with the Government. It now looked like being a good bargain for the Government.

South Metropolitan Electric Light and Power Co., Ltd.

Mr. H. St. J. Winkworth, presiding at the annual meeting on March 1st, said that the number of new consumers (313) was less than usual, as they had not carried out the usual extensions of small lengths of mains. The new mains laid were principally for giving bulk supply to the West Kent Electric Co. for power for factories, &c. The loss of revenue due to Government lighting restrictions was estimated at at least £8,000 to £9,000, but this was made good by new business and extensions. The total units sold increased by 37 per cent. to 9,185,742. The average price obtained was lower by reason of the bulk supply. The total sales in the show-room were £9,256, against £8,148, with £4,479 transactions, against 3,759. The total receipts were £80,576, as compared with £66,791. In regard to expenditure, coal had cost £5,700 more, owing to increased output, high freights, and inferior quality. In common with the other London companies, they increased their charges to consumers by 10 per cent. at the end of March, 1915. The total expenditure was 39 per cent. of the gross receipts, as against 36 per cent. in 1914. Owing to an ambiguity in the trust deed as to what they had to set aside to depreciation and in what circumstances, they had been in negotiation with the trustees with a view to defining the obligations under the deed. They had decided to fall in with the wishes of the trustees, and had transferred the £20,000 placed to reserve account in 1913 and 1914 to the depreciation account, and had carried to the depreciation account £16,750. A letter received from the solicitors to the trustees for the debenture stockholders indicated that they would be able to come to an agreement. The directors had under consideration the best manner of dealing with the amount due to the company by the West Kent Co. for work done, approximately £30,000. It would probably take the form later on of an issue of capital by the West Kent Co., but the precise form had not yet been decided upon. The following figures show the progress of the West Kent Co.'s business:—1914, H.P. connected, 773; consumers, 59; gross revenue, £1,596; expenditure, £1,055; net revenue, £541. 1915, H.P. connected, 3,018; consumers, 531; gross revenue, £13,320; expenditure, £10,269; net revenue, £3,051. During the year considerable extensions, both of mains and consumers, had been made, securing important power loads of a substantial and durable character. The bulk of the energy had been taken from the supply mains of the South Metropolitan Co. In regard to the outlook, it was very difficult to say what would take place in these days, but their output at present was substantially more than at the corresponding period of last year, due mainly to the increased demand of the West Kent Co. On the other hand, it was difficult to obtain regular deliveries of coal, and owing to the exceptionally high freights now ruling it was impossible to say what coal would cost, but the average price was likely to be more than that paid last year. On the whole, the outlook was satisfactory.

Metropolitan Electric Supply Co., Ltd.

At the annual meeting on March 22nd an effort is to be made to secure the appointment of a committee of shareholders to examine into and report upon the position. A circular was issued last week asking for proxies in support of this move by to-day. The circular says:—"For some considerable time we, in common with many other shareholders of the above company, have been far from satisfied with the way in which its affairs have been administered. The dividend on the ordinary shares, which in 1905 was 10 per cent., has now fallen to 3 per cent., and we learn that three of the directors (Lord Avebury, Sir James Pender, and Mr. P. D. Tuckett, the latter having recently joined the board) are all so dissatisfied with the position that they have resigned their seats on the board. We feel the time has come for the shareholders to take some action to protect their interests."

The company has issued a reply to the circular, in which the Secretary writes:—"Without explanation the circular is entirely misleading. The board has not been satisfied recently with the conduct of affairs, and in June last decided upon a complete change of management. This has been effected, and it is on this change of management that the present opposition is presumed to have arisen. . . . The chairman will give the fullest explanation of the position at the general meeting."

Chelsea Electricity Supply Co., Ltd.

Mr. W. R. Davies, presiding at the annual meeting, on March 8th, expressed regret that, owing to the class of demand in districts like theirs, the year's working necessitated a reduction in the dividend. Some of the companies in the Metropolitan area who could command a power load had done better than in 1914, but this company's business, which was for domestic and shop lighting, had again been adversely affected, not only by the increased lighting restrictions and by the desire to economise, but also by the fact that there was at present no London season with its entertainments and festivities. The units sold were 149,000 less, being 3 per cent. to 4 per cent. below those of the previous year, but low-priced power units showed an increase of 12 per cent., and the reduction in the sale of the higher priced units was nearly 10 per cent. They had been fortunate in fuel expenses, which showed a reduction of £950. This was partly due to the fact that the Diesel plant had been running for the whole year and had taken the bulk of the load, and that the cost of oil had not increased in anything like the same proportion as the cost of coal. It was also partly due to their purchasing more current from the Central Electricity Co., so that the amount generated had been proportionately less, and, to some slight extent, to their having sold fewer units. Repairs and maintenance and other costs were about the same as last year, but there were two other items on the expenditure side of the revenue account which called for special remark: one was that a special provision for income-tax of £1,500 was now necessary on account of the high income-tax; and secondly, that they had paid £1,200 away to men on military service. These two items alone more than accounted for the reduced distribution. In regard to the prospects for the current year, they must not look forward to any improvements, and they might even be faced with a further reduction of profit. This was due to the price of oil having risen very considerably, and to the reduction in the demand for current, which was still proceeding. The output for the first two months of this year showed a reduction of 6½ per cent. over the corresponding period.

British Electric Transformer Co., Ltd.—The result of working for 1915 is considered satisfactory. After paying all manufacturing costs and expenses of administration, there remains a net profit of £21,095, plus £3,478 brought forward. Out of this £7,500 is put to reserve, £1,500 to depreciation reserve, 6 per cent. is paid on the preference, and 7½ per cent. on the ordinary shares, £837 is paid as extra remuneration to directors, and £4,604 is to be carried forward. Annual meeting: To-day.

Automatic Telephone Manufacturing Co., Ltd.—The ordinary share and transfer books are closed until 25th inst. for the purpose of preparing the dividend warrants on the ordinary shares for the year.

Doulton and Co., Ltd.—Dividend of 5 per cent., less tax, on the preference shares for 1913.

North Ormesby, South Bank, Normanby and Grangetown Railless Electric Traction Co., Ltd.—The annual meeting was held at Middlesbrough on the 9th inst. Mr. W. W. Storr, who presided, said, in moving the adoption of the balance sheet, that the share capital of the company was £40,000, of which 12s. per share had been called up, yielding £21,678. Sundry creditors amounted to £121, making a total of £21,799. On the expenditure side, the cost of the Acts, including the opposition to the Middlesbrough Corporation, had been £4,012, buildings and overhead equipment had cost £14,139, and land and sundries had involved an expenditure of £2,754, leaving a balance of £879. The contract for the cars had not yet been completed, and the system remained unopened, but they expected to obtain four cars by the end of April. When the ten cars were available they could start at once. The Board of Trade had refused to sanction double-deck cars.

South Metropolitan Electric Trams and Lighting Co., Ltd.—The total revenue for 1915 was £69,281. After adding the balance brought in, deducting all expenses, and setting aside £4,500 to renewals fund, there remains £15,486, and the directors recommend placing to reserve £4,500, payment of dividend at rate of 5 per cent. per annum on preference shares for year to December 31st, 1914, £8,478, to payment on account of preference dividend for year 1915 at rate of 1 per cent. £1,695, carrying forward £812. An agreement has been entered into with the County of London Electric Supply Co., Ltd., for the supply of current in bulk to the company's station at Sutton, which is accordingly being converted from a generating station to a sub-station. Supply from the County company was first taken on December 12th.

Stewarts and Lloyds, Ltd.—The directors, after setting aside £100,000 for depreciation, and after making provision for estimated contingencies, recommend dividends for the half-year to December 31st last at the rate of 6 per cent. per annum on the preference shares; at the rate of 10 per cent. per annum on the preferred ordinary shares; and for the year a dividend of 2s. and a bonus of 6d. per share on the deferred shares, placing £60,000 to general reserve, £20,000 to employés' benefit reserve, and carrying forward £100,000.

Listowel Electric Light and Power Co., Ltd.—At the annual meeting, held recently, the chairman said that the present position was most satisfactory, and the result of the third year's working was remarkable. The gross profits, after paying all working expenses, amounted to £322. In three years they had put to reserve £430. They recommended this year a dividend of 8½ per cent., carrying forward £32. They looked forward to a considerable expansion of business this year, when certain new works and plant required to cope with the demand had been completed.

Direct Spanish Telegraph Co., Ltd.—Dividends at the rate of 10 per cent. per annum, less income-tax, on the preference shares, and 6 per cent. per annum, less income-tax, on the ordinary shares (making 5 per cent. for the year) have been announced for the last half of 1915, and a bonus of 2 per cent. on the ordinary for the year, free of income-tax, is recommended.

Melton Mowbray Electric Light Co., Ltd.—At the annual meeting, held recently, it was reported that the revenue for the year, after adding the balance brought forward, amounted to £3,241, of which £2,286 was available for distribution. A dividend at the rate of 3 per cent. per annum was declared; £900 was placed to reserve for renewal of plant, and £786 is to be carried forward.

Reduction of Capital.—A petition for the reduction of the capital of the Compania de Electricidad de la Provincia de Buenos Aires, Ltd., and Red., from £1,350,000 to £825,000, is to be heard on March 21st.

Nairobi Electric Power and Lighting Co., Ltd.—An interim dividend at the rate of 6 per cent. per annum on the preference and ordinary shares for the last half of 1915, less income-tax, is being paid.

Scarborough Electric Supply Co., Ltd.—The profit for 1915 was £1,078; plus £2,002 brought forward. After providing for interest charges, and placing £1,000 to the depreciation fund, £1,716 is to be carried forward.

Western Telegraph Co., Ltd.—Second quarterly dividend 3s. per share, free of income-tax, for the year ending June, 1916, being at the rate of 6 per cent. per annum.

W. T. Glover and Co., Ltd.—After paying 5 per cent. on the ordinary shares, and transferring £20,000 to reserve and writing down investments, £11,700 is to be carried forward.

Launceston and District Electric Supply Co., Ltd.—The directors have declared a dividend of 3 per cent.

STOCKS AND SHARES.

Tuesday Evening.

Verdun is the cynosure of the eyes of finance as much as it is of those of the nation at large; and, hopeful views being entertained of the end of this colossal struggle, Stock Exchange markets on the whole are firm and cheery. The Budget is expected towards the end of the month, and the next War Loan early in April. City circles are discussing with animation the pros and cons of a popular loan in the shape of premium bonds; but that more money will have to be provided in some way or other before very long is obvious to everybody.

This consideration weighs but lightly upon current quotations for securities. There is a tendency to look beyond the war and to invest money in the shares of such undertakings as are now working under abnormally unfavourable conditions, such as will right themselves automatically when the war is over. The same motive which checks investment to any large extent in armament shares is at work in directing the search for issues at present depressed by the war clouds.

Such a development is one that should console the proprietors of electric lighting shares in these present darkened days. The war has bitten badly into profits, for reasons that are well known to the public, and to the investor in lighting shares particularly. But afterwards there should come such a reversal of fortune amply compensatory for the lean times through which the companies have passed; and those who are on the look-out for shares of such class might do well to include the electric supply market in their purview.

Circulars have been flying about in connection with the affairs of the Metropolitan Electric Supply Co. Three of the directors, Lord Avebury, Sir James Pender, and Mr. P. D. Tuckett, have resigned, and five shareholders are inviting support at the forthcoming general meeting, with a view to securing the appointment of a committee of shareholders to examine into, and report upon, the position. The directors, in reply, say that a complete change of management has been effected, and that the chairman will give the fullest explanation of the position at the meeting next Wednesday, March 22nd. Meanwhile, the price of the shares keeps dull at 2½.

Various ex-dividend markings have reduced other prices in this market to levels at which they pay handsomely, even on the basis of the reduced dividends declared in respect of 1915. There is accordingly plenty of scope for the far-seeing investor to whom reference has just been made. The City of London report is considered satisfactory, and the large increase shown by the expenses, as compared with those of the receipts, is regarded as a factor due entirely to the war. The Newcastle Electric Supply Co. has declared a dividend of 3½ per cent., making 6 per cent. for the year, which compares with 5½ per cent. paid in the previous twelve months.

Mexican matters are once more to the front, in consequence of the increased activity on the part of some of the insurgents, headed apparently by General Villa, who are making things lively on the Mexican-American frontier. Various United States citizens are said to have been killed in the Mexican raids; and once more, for the *n*th time, the expectation revives that President Wilson will take a firm stand and maintain a stiff upper lip in his demands for reform in Mexico. It is difficult to conceive that even President Wilson can be content with formularies on this occasion, because it is certain that if he cares to do so, he can command the support of his country in enforcing order into his turbulent neighbours of the Isthmus, and the sending of a few thousand American troops to Mexico really looks as though he "meant business."

Although this is regarded as something of an ultimate bull point for Mexican stocks and shares, it has not saved further falls in the railway and industrial securities. Mexico Tramway Firsts, for instance, are down 4 points, Mexican Light and Power common fell 2 to 20, and most of the bonds are more than ever difficult to realise.

Amongst other foreign descriptions, British Columbia Electric preference dropped 2 to 53, and there is noticeable weakness in Anglo-Argentine Tramways first preference, a fall of ¼ taking these to 3¼; while the second preference weakened in sympathy to 3⅜, as will be noticed from our lists of stocks and shares this week.

The feature in the market for Home Railway stocks is the buying of the low-priced issues. Gambling counters, many people would call them; but those who are putting money into such things contend that British railway systems of importance never come to a complete end, and that recovery sooner or later is inevitable. Therefore, the strength of Metropolitans and Districts is well maintained. Underground Electrics are duller. At the meeting held last week, Sir Robert Perks suggested that fares should be raised, but the chairman, Lord George Hamilton, stated that the adoption of such a policy would encourage competition and probably cause a great outcry throughout London. It was very easy to lose traffic, he said, but traffic once lost was very difficult to recover.

British Electric Tractions have been rather wanted, in consequence of the result of the law case which has just been settled by the Court of Appeal. The Public Trustee, as executor for a deceased large holder of income certificates in the company, sought to show that he was not bound by the scheme for reducing the capital. But the judges held that the directors had acted in perfect good faith; and upon the evidence before the Court, their lordships were of opinion that the appellant, by accepting the stock and shares under the scheme, ran no risk of incurring any future liability in respect of them. The preference stock was dealt in on Monday at 72, and the 7 per cent. non-cumulative preference at 46 a week ago; while the most recent bargains in the preferred and deferred were at 16 and 10¼ respectively. No doubt the company will now press forward the completion of its scheme, and proprietors will hope to be in possession of their new securities before long.

The Metropolitan Electric Tramways, in its report, shows a falling away of £18,000 to £513,600 in its gross revenue for last year. The company carried 3,669,000 fewer passengers, but the average fare was higher. The net revenue, however, comes out at only £3,000 less. The ordinary dividend is 1 per cent., against 2 per cent. a year ago. The price of the 4½ per cent. debenture stock is 78½, and the 5 per cent. debenture stock stands about a point lower.

Canadian lighting and power issues are creeping up again, and the American companies are sharing in the industrial activity produced throughout the States by the war conditions of Europe. The Pennsylvania Water & Power increased its profits, and announces that a new concern has been formed, called the Shawinigan Electro Products Co., the objects of the latter being to manufacture and sell electric furnace products.

Telegraphs and telephones are wholly placid. Business is quiet in this section, and there are no changes to report on the week. Telegraph Constructions are quoted ex the dividend of 36s., allowing for which they show a loss of 1¼. Babcock & Wilcox are strong, the price stiffening to 2¾ on buying from the North. The other manufacturing issues are, on the whole, a good market. Rubber shares remain firm, business in them being more active than in anything else round the Stock Exchange. Considerable animation characterises the department devoted to base-metal shares, more particularly those of the Broken Hill group. The copper division is a little uncertain of itself, by reason of the frequent and violent fluctuations in the price of the metal.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1914.	Dividend 1915.	Price March 14, 1916.	Rise or fall this week.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	10	—	7	—	£7 2 10
Charing Cross Ordinary	5	5	8½ xd	—	7 13 10
do. do. do. 4½ Pref.	4½	4½	8½	—	8 18 6
Chelsea	5	4	8½ xd	—	5 14 4
City of London	9	8	11¼	—	6 14 9
do. do. 6 per cent. Pref.	6	6	10⅝	—	8 14 3
County of London	7	7	1 ⅛	—	6 15 0
do. 6 per cent. Pref.	6	6	10⅝	—	5 17 3
Kensington Ordinary	9	7	5⅞ xd	—	6 1 9
London Electric	4	3	1 xd	—	9 0 0
do. do. 6 per cent. Pref.	6	6	4⅛ xd	—	7 5 5
Metropolitan	3½	3	2⅛	—	8 4 8
do. 4½ per cent. Pref.	4½	4½	8	—	7 10 0
St. James' and Pall Mall	10	8	5⅞	—	8 13 10
South London	5	5	3 xd	— 1/16	8 6 8
South Metropolitan Pref.	7	7	1 1/16 xd	+ 3/32	6 14 0
Westminster Ordinary	9	7	5⅛	—	6 1 9
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.		6	100	—	6 0 0
do. Def.		33/6	21⅜	—	7 16 0
Chile Telephone		8	6⅜	—	6 5 6
Cuba Sub. Ord.		5	7⅜	—	6 9 0
Eastern Extension		7	12⅜	—	*6 5 0
Eastern Tel. Ord.		7	127	—	*6 5 6
Globe Tel. and T. Ord.		6	10⅜	—	*6 10 6
do. Pref.		6	10	—	6 0 0
Great Northern Tel.		22	34½	—	6 7 6
Indo-European		13	49½	—	6 12 6
Marconi		5	1 1/16	—	5 8 1
New York Tel. 4½		4½	100½	—	4 9 4
Oriental Telephone Ord.		10	1¼½	—	5 18 6
United R. Plate Tel.		8	5⅛	—	*7 19 0
West India and Pan.		1	1 1/16	—	9 10 6
Western Telegraph		7	12¾	—	*6 5 0
Home Rails.					
Central London, Ord. Assented		4	67½	—	5 *8 6
Metropolitan		1½	23	—	4 7 0
do. District		Nil	16	—	Nil
Underground Electric Ordinary		Nil	1⅜	— ⅛	Nil
do. do. "A"		Nil	5/6	—6d.	Nil
do. do. Income		6	81¼ xd	— ½	*8 10 0
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.		6	4⅞	—	6 3 1
Anglo-Arg. Trams, First Pref.		5½	3⅞	— ¼	7 2 0
do. 2nd Pref.		5½	⅝	— ⅛	8 3 0
do. 5 Deb.		5	78	—	6 8 2
Brazil Tractions		4	50½	—	6 18 7
Bombay Electric Pref.		6	10	—	6 0 0
British Columbia Elec. Rly. Pfce.		5	53	— 2	9 8 8
do. do. Preferred		—	38	—	Nil
do. do. Deferred		—	34	—	Nil
do. do. Deb.		4½	64	—	6 12 10
Mexico Trams 5 per cent. Bonds		—	35	— 4	Nil
do. 6 per cent. Bonds		—	35	—	Nil
Mexican Light Common		Nil	20	— 2	Nil
do. Pref.		Nil	35	—	Nil
do. 1st Bonds		—	40	— 1	—
Manufacturing Companies.					
Babcock & Wilcox		14	2⅜	+ ⅛	5 1 8
British Aluminium Ord.		5	22/9	—	4 8 0
British Insulated Ord.		15	11	—	7 19 1
British Westinghouse Pref.		7½	44/6	—	6 14 6
Callenders		15	11½	—	6 10 5
do. 5 Pref.		5	4¼	—	5 17 8
Castner-Kellner		20	3⅛	—	6 8 0
Edison & Swan, £3 paid		Nil	7/-	—	Nil
do. do. fully paid		Nil	1½	—	Nil
do. do. 5 per cent. Deb.		5	60	—	8 6 8
Electric Construction		6	14/9	—	8 1 6
Gen. Elec. Pref.		6	9⅜	—	6 4 8
Henley		20	14½	—	*9 10 1
do. 4½ Pref.		4½	4	—	5 12 6
India-Rubber		10	9½	—	*12 19 0
Telegraph Con.		20	34 xd	— 1½	*7 19 0

* Allowance made for dividends being paid free of income-tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, March 15th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/4	..
a Ammoniac Sal	,,	£70	..
a Ammonia, Muriate (large crystal)	per ton	£54	..
a Bisulphide of Carbon	,,	£23	..
a Borax	,,	£28	..
a Copper Sulphate	,,	£43	..
a Potash, Chlorate	per lb.	2/1	6d. inc.
a ,, Perchlorate	,,	2/-	..
a Shellac	per cwt.	95/-	..
a Sulphate of Magnesia	per ton	£18	..
a Sulphur, Sublimed Flowers	,,	£14	..
a ,, Lump	,,	£9	..
a Soda, Chlorate	per lb.	1/4½	..
a ,, Crystals	per ton	60/-	..
a Sodium Bichromate, casks	per lb.	10d.	..
METALS, &c.			
c Brass (rolled metal 2" to 12" basis)	per lb.	1/4½ to 1/4½	½d. dec.
c ,, Tubes (solid drawn)	,,	1/5 to 1/5½	..
c ,, Wire, basis	,,	1/4½ to 1/4½	½d. dec.
c Copper Tubes (solid drawn)	,,	1/6½ to 1/7	..
g ,, Bars (best selected)	per ton	£148	..
g ,, Sheet	,,	£148	..
g ,, Rod	,,	£148	..
d ,, (Electrolytic) Bars	,,	£137	..
d ,, ,, Sheets	,,	£155	..
d ,, ,, Rods	,,	£144	..
d ,, ,, H.C. Wire	per lb.	1/5	..
f Ebonite Rod	,,	8/-	..
f ,, Sheet	,,	2/6	..
n German Silver Wire	,,	2/3	..
h Gutta-percha, fine	,,	6/10	..
h India-rubber, Para fine	,,	3/2½	½d. inc.
i Iron Pig (Cleveland warrants)	per ton	85/6	2/6 inc.
l ,, Wire, galv. No. 8, P.O. qual.	,,	£32	..
g Lead, English Pig	,,	£35 15	£2 inc.
g Mercury	per bot.	£16 15	..
e Mica, (in original cases) small	per lb.	6d. to 8/-	..
e ,, ,, ,, medium	,,	8/6 to 6/-	..
e ,, ,, ,, large	,,	7/6 to 14/- & up.	..
d Silicium Bronze Wire	per lb.	1/8½	..
r Steel, Magnet, in bars	per ton	£85	..
g Tin, Block (English)	,,	£193	£4 inc.
n ,, Wire, Nos. 1 to 16	per lb.	2/9	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
r W. F. Dennis & Co.

Field Water-Purification Plant.—A recent issue of the *Canadian Engineer* contained a description of a portable ultra-violet-ray sterilisation plant, designed and installed by Captain F. A. Dallyn, to provide a better water supply to the Ontario troops in a Canadian camp. The water is pumped from the Niagara River, which is greatly polluted, through a mechanical filter of the reverse-flow type, mounted on a four-wheeled wagon. From this it goes to the sterilising apparatus, passing through three quartz tubes, to each of which is attached an ultra-violet-ray lamp, the emanations reaching the water through the quartz. The tubes, 4 in. long by 1½ in. diam., are carried in a casting, and watertight joints are secured by means of rubber gaskets. Three windows are provided in the casting, through which the operator can watch the lamps, &c. The outfit includes a Westinghouse generator, engine, and Albany pump. Current is supplied by a 2½-KW. 220-volt direct-current dynamo; the pump is a 2½-in. water-sealed rotary type machine, with a capacity of 3 000 gallons at 250 R.P.M. These are driven by a 9-H.P. Lister vertical petrol engine, fitted with automatic pump lubrication, enabling it to run between 200 and 250 hours without refilling the oil chamber, pump-fed carburettor, &c. The plant was purchased by the Government upon the recommendation of the assistant director of medical service; it has reduced the normal count in raw water of 4,000 bacteria per c.c. to from 10 to zero. Colon bacilli were commonly present in 0·01 c.c., but after sterilisation were normally absent in 50 c.c.

Economy in Carbons.—About nine months ago the Electrical Engineering and Equipment Co., Ltd., of 109-111, New Oxford Street, W.C., offered a prize of £25 to the kinematograph operator who could show the biggest saving by the use of "Reflex" carbons during a period of six months, as compared with a similar period using any other make. We are informed that the prize has been awarded to Mr. C. J. Lord, of the Princess Picture Palace, Rawmarsh, Yorks., who reduced his energy consumption from 2,560 to 1,890 units, or 26 per cent., finding that with these carbons he could use a current of 25-30 amperes instead of 30 40 as formerly, and yet get a better and whiter light.

THE RENAISSANCE OF THE LOW-TENSION FUSE.

By JOHN A. CRABTREE.

(*Concluded from page* 277.)

Reference has already been made to the heating up of the fuse handle. This is, of course, aggravated with longer break fuses, and is an argument against the unnecessary extension of the break. Further, such heat represents wasted energy, and therefore money.

Consider for a moment a 6-way T.P. 4/50-amp. per way 500-volt fuseboard, 6-in. break fuses, as shown in fig. 3. The length of wire will be about 10 in. for each fuse (terminal to terminal) or a total length of 15 ft. The fuses

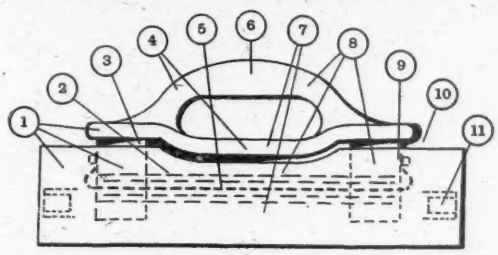

Fig. 3.

are wired with two strands 21 S.W.G. tinned copper, having a total resistance when hot under working conditions of about ·165 ω —

$$\therefore C^2R \text{ loss} = 400 \text{ watts (approx.)}.$$

The yearly cost of this, working 60 hours per week at 1d. per unit = £5.

If, therefore, the same safety could be procured with suitably designed shorter break fuses, having a fuse-wire length of 5 in. from terminal to terminal, a running cost saving has been effected of £2 10s. per annum.

Fuse Wire.—Tinned copper wire is almost universally used, is easily procured and generally handy. The question

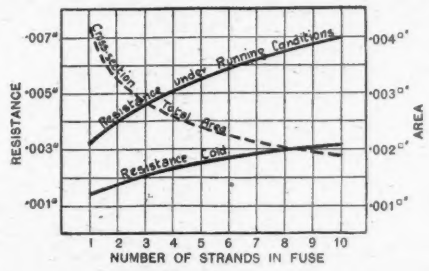

Fig. 4.

of few or many strands requires attention, and here we are between two alternatives. In the graph, fig. 4, are plotted three curves for open-type fuses, blowing at 200 amperes, one curve giving the total cross-sectional area, and the second and third curves the approximate total resistance of various stranded fuse wires (hot and cold).

It will be seen that the greater the number of strands the greater the resistance (and, therefore, the C^2 R loss), and the less the total cross-sectional area. It is thus perfectly obvious that while a fuse with few strands will have a greater explosive effect on a "short," owing to the greater amount of metal volatilised, it will be distinctly cooler in working. On the other hand, the many-stranded fuse, while having a lower explosive effect, will have the disadvantage of excessive heating to contend with. Premature blowing, disintegration of the insulation, softening of the spring contact clips, handles too hot to hold, excessive waste of energy—all these are the frequent results of the many-stranded fuse.

That the waste of energy is not entirely a negligible item may be seen by considering a factory wired for 10 50-H.P. motors, 440 volts D.C., and having 20 fuses wired to carry 100 amperes normal. Having the fuses similar to fig. 3, the total C^2 R loss (hot) will be :—

For single-strand wire (14 S.W.G.) = 600 watts approx.
For six-strand wire (23 S.W.G.) = 1,100 watts approx.

Allowing for 60 × 50 = 3,000 running hours per annum, we have the following result at 1d. per unit :—

Loss with single-strand wire = £7 10s. per annum.
Loss with six-strand wire = £13 15s. per annum.

Therefore, the additional loss with six strand = £6 5s. per annum, or about 12s. 6d. per annum for each 50-H.P. motor installed.

Porcelain Insulation.— Porcelain is the material almost universally adopted in this country for the insulating shields and handles. It may be said to be fairly cheap to produce, can be moulded to any reasonable requirements, and is an excellent insulator. On the debit side it is brittle, cannot be worked up after firing, cracks badly under local heat, and possesses little mechanical strength. Satisfactory fuse design must make full allowance for these weaknesses, or an unreliable fuse will be the result.

From the national point of view already referred to, one feels compelled to admit that our home Potteries have something yet to learn from the foreign, and particularly the German, competitor. Why this is so, one cannot say. Whether it is a question of the clays used, the mixing, moulding, or firing, is a matter for the Potteries to decide : but undoubtedly the future of our electrical switchgear industry is largely bound up with the enterprise and foresight of our porcelain manufacturers. The firm discovering the secret (if secret it is) of the German porcelain—its clean accuracy, excellent vitreous body, and low price—will find a fortune awaiting it after the war.

Damaged Fuses.—The distinctive forces operating upon the fuse may be classed under five headings.

I. Ordinary wear and tear.
II. The explosive force of the arc.
III. Sudden expansion stresses set up in the insulating material by heat.
IV. Damage to the metallic parts, by arcing.
V. Loosening of parts.

I. *Ordinary Wear and Tear.*—This factor requires attention in all mechanical contrivances, and needs little mention, beyond what is later covered by Sec. IV.

II. *The Explosive Force of the Arc.*—This may be considerable on any but the very smallest of fuses, and unless means are taken to counteract the danger, the fuse will be useless after the first "dead short" or heavy overload. It is, therefore, necessary to make suitable provision. Ample ventilation should be provided, where it is desired that the gases should escape ; and suitable deflectors should be fitted wherever there is any possibility of arcing across poles or to earth. Special safeguards, such as cartridge fuses, magnetic blow-outs &c., need not be here elaborated.

III. *Sudden Expansion Stresses.*—Few designers seem to pay any serious attention to the excessive local heat stresses set up in ordinary fusegear. Yet if the trouble of broken china is sifted to its root cause, it will be found that a large proportion is damaged through this cause.

Take, for example, the old tubular hand-grip fuse. The writer has noticed that a large proportion ultimately fracture, as shown in fig. 1, p. 276. An examination of the fragments shows that the initial cracks are often of long standing, and their gradual extension may be distinctly traced. The last "blow," of course, smashes the handle, already weakened by the earlier cracks, and the internal expansion stresses set up by the sudden heat. It therefore seems a reasonable conclusion that the heavy metallic ends and large cooling flanges at A rapidly absorb the heat, while the central, or hand-grip section B, can only dissipate the heat by a slow radiation. The difference in temperature, therefore, between parts A and B sets up stresses at C, and fractures the china. It has also to be recognised that the rapid heating up of the china round the core hole, also sets up stresses round the outside of the handle, frequently causing this to crack, as at D.

The old ventilated tubular fuse of Reyrolle make was, perhaps, one of the best tubular hand-grip fuses ever made, on account of the special consideration given to the question of ventilation around the fuse wire tube. This ventilation not only served to keep the handle cool for handling, but also prevented undue heat stresses cracking the porcelain.

It is advisable to keep the hot fuse wire from contact with the porcelain, and the provision of asbestos tubes, braiding or pads, is decidedly necessary to shield the porcelain at the vital parts from the excessive heat.

IV. *Damage to the Metallic Parts by Arcing.*—It is impossible to entirely avoid this when ordinary fuse wire is used. Where fuses of any size are in question, however, it should be possible to so arrange the design that the arcing at the terminal blocks will not affect the re-wiring and contact surfaces. Some fuses burn up the fuse wire terminals, so that it is quite impossible to loosen the screws for re-wiring, and one is compelled in emergency to merely coil the fuse wire round the binding terminal. Others burn up the terminal faces, and occasionally weld fuse and base contacts in one mass. A method sometimes adopted consists in leading the fuse wire through a small hole in the insulation. This works all right if the fuse does not blow in the hole. When it does, however, the cure is as bad as the ill, and a blocked or shattered fuse is the result.

V. *Loosening of Parts.*—This principally occurs on A.C. circuits, but should, of course, be considered as a matter for standard design, and lock-nuts, spring non-return washers, and substantial screw-driver slots to all thumb-nuts and screws, should be supplied without question. Unfortunately, price only too often enters into these refinements of design, and a good fuse is spoilt by the general objection to pay the fractional additional costs entailed.

Cabinets (*Wood and Iron*).—The size and ventilation of cabinets have each a considerable effect upon the fuses enclosed. Fuses that are cool in operation in the open air will often heat up excessively in a confined space, and cause endless trouble. Softened contacts (particularly the upper ones), pitted contact surfaces, and premature fuse blowing, are all the results of this cause. Wherever possible, cases should be suitably ventilated, or have sufficient volumetric capacity and cooling surface to counteract this tendency. The sudden rise in pressure owing to a fuse blowing, has also to be taken into consideration. With conduit wiring, the gases have an opportunity of escaping up the tubes, but where armoured or other cables which present no outlet to the gases, are used, a serious rise in pressure may result. Occasions have been known where locks have been smashed, and heavy doors blown open through this cause. Apart from plain holes, the breathers shown in fig. 5 have been adopted with success.

The clearance from live metal to case requires careful attention, for while a minimum clearance of one inch may

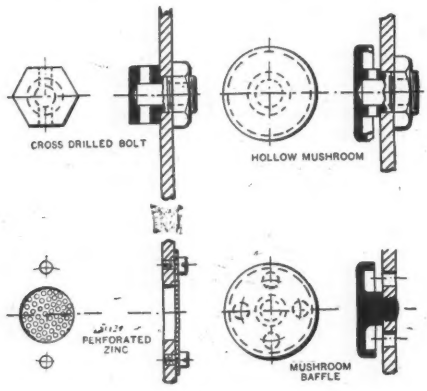

Fig. 5.

be ample under ordinary conditions, there are often circumstances where such a clearance is quite useless. Consider the case of fuses on circuits with an earthed return, where one has the full voltage between the lead in terminals, and the iron case. In the event of a blow, the arc has a strong tendency to jump to earth and burn out the whole fuse-box in a "dead short." Where, therefore, there is any possibility of a fuse blowing to earth, suitable deflector plates or shields should be fitted at the required positions, unless it is possible to combine such shields in the design of the fuse unit. Asbestos lining is often worse than useless, unless well varnished, and micanite or vitreous enamel put a board outside a competitive basis. It is much better to have a correctly designed board than to resort to makeshift safeguards.

Wiring Arrangements.—The question of wiring should be carefully considered, and it is to be regretted that designers are not compelled by law to pass through a stringent course of training, in wiring up their own boards. Boards are often delivered and found to be absolutely unwirable. Battens have to be carved and hacked away, bases packed up, cables twisted into unnatural kinks, and conduit brought all round the case to obtain a suitable entry. It is also to be regretted that buyers seldom know what they want when ordering. To make a first-class job with a board of any size, the position of entry of the cables should be considered, and settled, before the board is set out. The board should be built round the cables, not the cables round the board. For a little extra cost on the layout of the boards, pounds would be saved in the connecting up. Instead of manœuvring heavy cables into impossibly placed sockets, heavy cables should lead in direct, with little or no bending of any kind whatever. Yet how often is the manufactu er held up till the very last minute for the position of the cable entry into the case, and expected to deliver the job complete by return. The buyer arranges his cables to enter N, S, E or W, as it pleases him, and then curses the makers for supplying an unwirable board.

To sum up: We have yet to obtain the ideal fuse, but the following leading features may be considered as essential in its development (see also fig. 3).

1. **Substantial, electrically and mechanically.**
2. **Must pass stringest short-circuit tests without damage to itself.**
3. **No danger of accidental contact with live parts, whether fuse is "in" or "out."**
4. **Safe to handle, even if inserting on a short.**
5. **Fuse wire as short as possible, compatible with safety, and reliability.**
6. **Well-ventilated handle, cool in handling.**
7. **Porcelain free from excessive heat stresses.**
8. **Should not overheat when enclosed in iron case.**
9. **Easily re-wired, and free from danger of burnt-up terminals.**
10. **No possibility of arcing to iron case.**
11. **Fuseboards easily connected up, with as little bending of heavy cables as possible.**
12. **Inexpensive.**

CONTINUOUS-CURRENT RAILWAY MOTORS.

A paper on the above subject, by Mr. E. V. Pannell, was read before the Institution of Electrical Engineers and discussed on March 9th; an abstract of the paper appeared in our last issue.

Mr. F. W. Carter, who opened the discussion, said the paper was very opportune, the subject being highly specialised and the literature on it being behind development. The author was wise in limiting the subject to motors for multiple-unit trains; he thought he attached too much importance to the hourly rating, which was not in any sense a criterion of the service capacity of this type of motor, and there had been considerable discussion as to whether it should be retained for that reason. He, therefore, disagreed that the one-hour rating represented the maximum desirable current during acceleration; although this was probably true of the old tramway motors, modern commutating-pole machines often accelerated at much higher than the one-hour rated capacity. In this country we should require much larger clearances than were indicated by the author in his reference to linear dimensions. When the ventilated motor was first introduced, it was feared that it would pick up dust, snow, &c., but now from 15,000 to 20,000 of this type had been sold by one American concern alone, representing 1½ million H.P. The author was wrong in stating that the Central London motors were semi-ventilated with hollow shafts; some motors of this type for use in America had been experimentally made, but abandoned because of brake dust getting into them, and the Central London motors had solid shafts, like the District motors. Referring to the 200-kw. 1,200-volt ventilated motor shown in fig. 8, the bearings were very small, and a bad feature; they were much smaller than usual, and less than those on the new Lancashire & Yorkshire, and South-Western motors. He thought an extra 4 or 5 inches in bearing length would be required for satisfactory service. The design also showed a lip on the commutator used as an oil thrower, which was a bad feature and would, he suggested, require replacing with a proper oil thrower, and these alterations would, he considered, reduce the core length to less than the 18 in. shown. It was true that roller bearings might be considered, but

experience with them was lacking. He very much doubted whether a 200-kw. ventilated motor of ordinary design could be got into the ordinary gauge, without recourse to large wheels or roller bearings, even with the smaller commutator due to using 1,200 volts. Artificial limitations, such as due to the one-hour rating, were undesirable.

Prof. S. P. Smith was interested to notice the author's advocacy of field control, although it was in use before the series-parallel control became the vogue; now it was coming back in combination with the latter. The unfortunate part about all such arrangements was that it was not economical to increase the types in use on existing systems, and it might involve great capital cost to convert to field control. He could not quite agree with some of the author's data regarding recently developed machines; the 600 and 1,200-volt. machines were reasonable, but he thought the 1,800-volt machine was open to criticism. For instance, 20 volts average per segment might mean a maximum of 30 volts, which, he thought, would lead to sustained sparking between segments; the segment pitch was necessarily small. It would be interesting to know whether any such voltage had been used. The segments per slot were also numerous, and the design appeared to be an effort to do the work with too small a motor.

Mr. Lydall said inside the motor there was very little room for field connections, and these should be kept to a minimum. In regard to field control, the diverter was one method, but, as mentioned in the paper, it had given trouble through flashing over, and it had been proposed to use a relay to cut out periods of the weak field, but to get a satisfactory relay was the difficulty. Part of the field winding could be cut out in various ways; it was possible to cut out the two bottom poles or alternative poles, but there might be trouble with both ways. Then there was tapping off the middle point, which was, perhaps, the best thing to do. He agreed that it was undesirable to talk about the maximum value of the average voltage, which meant nothing; the factor was the maximum voltage.

It having been suggested by one speaker that diverters might be made inductive with advantage, Mr. Highfield stated that in connection with the series wound Thury machines used by his company the diverters had been altered from non-inductive to inductive with satisfactory results. Previously, they had had trouble with the diverters such as was indicated in the paper.

Mr. Roger Smith, who in the absence of the author had read the paper, replied to one or two points on his behalf. The author, he said, had mentioned that too much importance should not be attached to the one-hour rating, and had advocated service rating. The Engineering Standards Committee had not yet legislated for railway motors in this country, and for the time being we practically used the American standards. He agreed, on behalf of the author, that the 200-kw. ventilated motor shown had serious defects from the railway operating point of view; there was too little clearance between the end of the commutator and bearing. The railway motor was a pure compromise, and the less difficulty put in the way of the designer, and the more they asked only for results, the better the results would be. Field control was one of two things making the d.c. series motor really useful; the other feature was regenerative control, and both were of singular importance in railway work.

CONTROL EQUIPMENTS FOR WINDERS AND HOISTS.

The apparatus illustrated and described in the following article has been specially developed by the British Thomson-Houston Co., of Rugby, for the control of electric motors used for winding and haulage in collieries, and furnace hoists in steel works.

Each equipment consists of a drum-type master controller, a panel on which electrically-operated air-break contactor switches are mounted, and control resistances of the air-cooled type.

The operator can start, stop, and reverse the electric motor by means of the master controller, the contactors closing automatically when the controller handle is moved. The closing of the contactors can only occur in the correct sequence, and each contactor remains open until the motor has accelerated sufficiently to permit additional resistance to be cut out of circuit without excessive current being taken from the line. Thus, even if the operator moves the control handle too quickly from the "off" position to the "full on" position, the current limit relays on the contactor panel will automatically protect the motor against damage and permit it to be started up in the shortest time compatible with safety.

These contactor equipments are particularly suitable for winders and hoists, and possess the following advantages over liquid controllers, as clearly explained in the paper by Mr. J. H. Rider, on "The Power Supply of the Central-Rand Mines Group," read before the Institution of Electrical Engineers on December 9th, 1914.

(*a*) No heavy work is imposed on the driver in operating the control lever.

(*b*) No energy is wasted in continually pumping electrolyte.

(*c*) The full speed of the motor is obtained, as, when the last rotor switch closes, the rotor is metallically short-circuited.

(*d*) No energy is wasted in the rotor resistance during the period of full-speed running, but only during the periods of acceleration and retardation.

(*e*) There is no risk of flashing over, however quickly the control lever is operated.

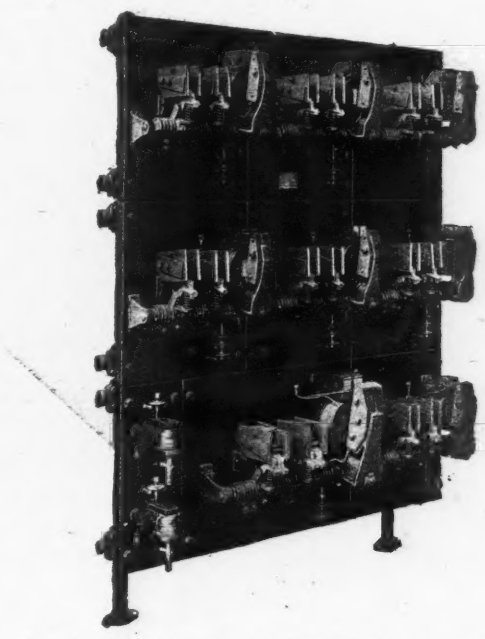

Fig. 1.—Contactor Panel for Rotor Circuit of 400-h.p. Induction Motor.

(*f*) There is no cooling pipe system to be kept clean and in order.

(*g*) The rate of accelerating the speed of the motor is automatically controlled by a relay system, so that, although the control lever may be put right over at the start, no succeeding switch closes until the current, which has increased on the closing of the preceding switch, has fallen to a predetermined and adjustable amount.

Contactor Panels.—For alternating-current slip-ring motors, one set of contactors is provided for opening and reversing the stator connections, and another set for short-circuiting the resistance divisions in the rotor circuit.

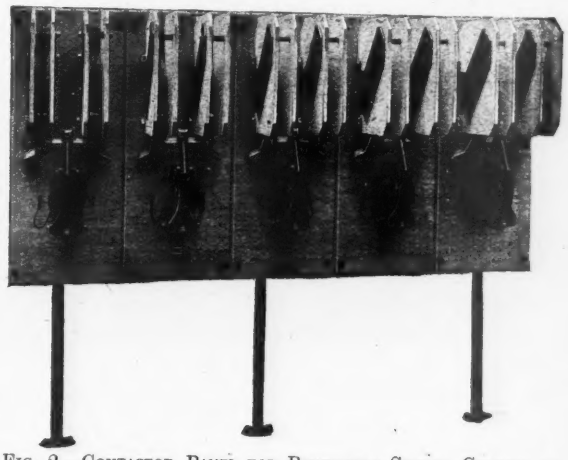

Fig. 2.—Contactor Panel for Reversing Stator Circuit of 3,300-volt Induction Motor.

Air-break contactors are recommended for this service, even for line voltages up to 3,300, as the wear on these is less than that on contactors breaking under oil.

A typical contactor equipment for reversing stator circuits is shown in fig. 2.

The contactor panel shown in fig. 1 is a typical panel for use in the rotor circuit for cutting out the controlling resistances.

For line voltages of 650 and less the contactors for controlling the stator circuit are mounted on the same panel as the rotor contactors, and are of the same general type as the rotor contactors. A typical panel is shown in fig. 3.

For direct-current motors the contactor panel consists of four contactors used for reversing the armature connections,

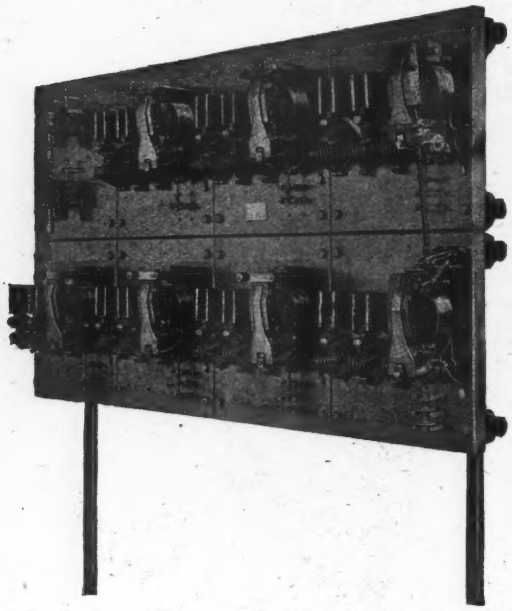

Fig. 3.—Contactor Panel for Stator and Rotor Circuits of 200-h.p., 650-volt Induction Motor.

and a number of other contactors for short-circuiting the divisions of the starting resistance. Fig. 4 shows a typical contactor panel for reversing a direct-current motor.

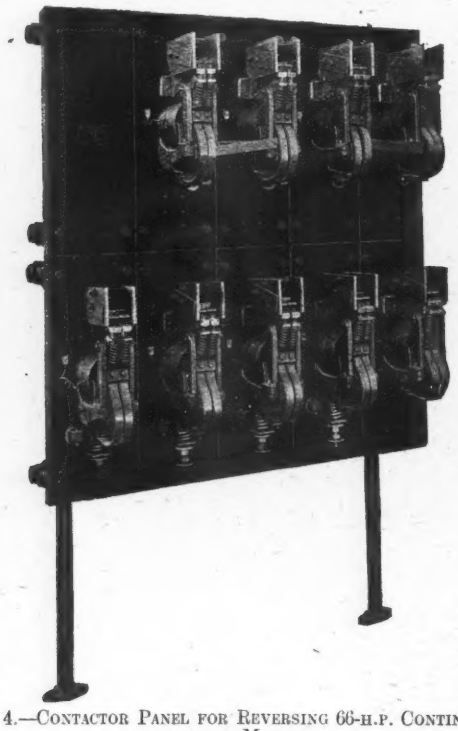

Fig. 4.—Contactor Panel for Reversing 66-h.p. Continuous-current Motor.

Resistances.—The resistances used for this service consist of iron grids mounted on mica insulated rods which are fixed to the main resistance frame. Pure mica washers are used for insulating the grids from each other and from the frame.

For small motors the resistance units are mounted as shown in fig. 5. This form of frame consists of a number of separate boxes, the end castings of each box being arranged with lugs for bolting to similar frames on the top, bottom, and sides, so that any number of boxes can be bolted together to form a complete resistance.

This form of mounting is recommended in cases where the total resistance necessitates the use of not more than six boxes.

For large motors, where more than six resistance boxes are required, the units are mounted as shown in fig. 6. In this case the end castings are dispensed with, and the rods carrying the grids are assembled in an iron pipe framework.

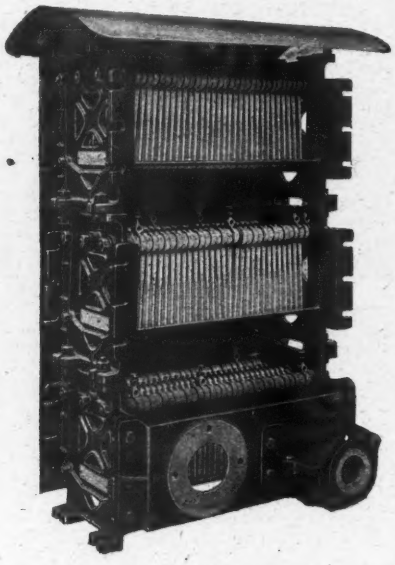

Fig. 5.—Type C G, Form G G, Resistance with Junction Box. (Side cover removed.)

Master Controller.—The motor can be started, stopped, and reversed by means of the master controller, which is of the British Thomson-Houston standard tramway type.

This controller makes or breaks the circuit of the contactor switches, which then automatically controls the current flowing to the motor independent of the operator.

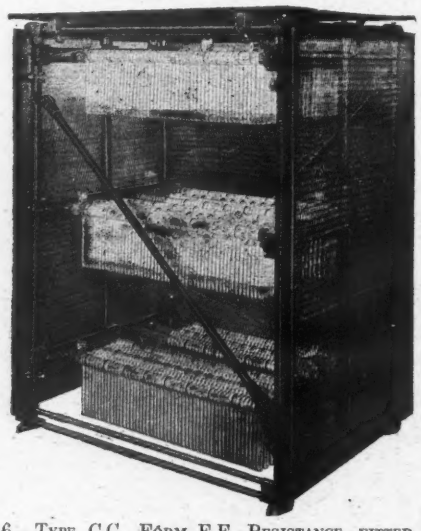

Fig. 6.—Type C G, Form E E, Resistance, fitted with Insulating Rods. (Side cover removed.)

Control equipments as described are operating satisfactorily in mines in Great Britain and other parts of the world.

TAR OILS AS FUEL FOR DIESEL ENGINES.

At the February meeting of the Diesel Engine Users' Association, Mr. W. Batho, of Messrs. Sulzer Bros., remarked that the price at which they had been accustomed to buy mineral oils had been such that there was nothing to induce manufacturers of Diesel engines to expend large sums in experiments; for years past, however, the Continental journals had contained a large amount of information on the subject. In Switzerland, about 140 Diesel engines installed by Messrs. Sulzer Bros. were nearly all running on tar oil prior to the

outbreak of war, the sizes varying from 20 to 1,000 B.H.P. This tar oil was all imported. Messrs. Sulzer Bros. had carried out long experiments with vertical-retort tar and had designed a special method of burning it. After the outbreak of war they installed their own tar distillation plant, and the results had been very satisfactory. The reason why they installed this plant instead of using ordinary tar was that although the latter gives fairly good results, it is not such a clean and satisfactory fuel as tar oil. Further, vertical-retort tar can, as a rule, only be obtained in small quantities, and other kinds of tar require distillation to make a satisfactory fuel. It is also more economical to use tar oil, as the valuable by-products, such as benzol, toluol, ammoniacal liquors, and anthracene, would be lost if the tar were used direct in the Diesel engine.

In France, where they had installed some 50 engines, tar oil was almost universally in use. The sizes varied from 20 to 3,500 B.H.P.

The greater part of Messrs. Sulzer Bros.' engines run with tar oil without any auxiliary fuel pump, and this refers particularly to their two-stroke engines. A great deal, however, depends upon the conditions under which the engine has to work, and in some cases they have fitted their own design of auxiliary pump with a pilot jet for ignition purposes. They have found that it is not sufficient to inject a drop of oil in a solid state, so to speak, in advance of the main fuel charge, but this ignition drop requires to be properly pulverised in the same way as the main fuel supply. Unless this is done, the initial combustion is impaired, and it also considerably increases the consumption of the ignition fuel.

Light oils, such as benzol, with a low flashpoint, are not suitable for Diesel engines. The heavy tar oils are almost all suitable. It is possible that when oil has been stored, especially during cold weather, a certain amount of crystallisation takes place. These crystals usually consist of fuel of high value, which, by sufficient heating of the tar oil, as a rule become easily dissolved. In purchasing tar oils the following points should be considered:—

The specific gravity should be between 1 and 1.1.

The lowest flashpoint is about 70 deg., but for safety against fire it should be in the neighbourhood of 100 deg. to 130 deg. F.

Tar oils are as a rule dark to almost black. One drop on white paper should show no black residue, as is the case with tar. This black residue means a large percentage of free carbon or other tar ingredients.

The lower calorific value is between 15,800 and 16,500 B.TH.U.

The unburnt residue of tar oil should not exceed 1 per cent.

The amount of water should not exceed 1 per cent.

With coal tar oils the sulphur contained can be from 0.5 to 1 per cent.

If the tar oil contains a high percentage of residue which only begins to vaporise at 400 deg. C., the same results can be expected as with tar; that is to say, one must anticipate a considerable amount of dirt in the engine, and the exhaust valves will require frequent cleaning and grinding in.

With gas tar the most important point is the contents of asphalt and pitch. Tar obtained from the manufacture of gas in vertical retorts can be used without difficulty by the adoption of an auxiliary fuel pump and specially prepared lubricating oil. Tars from horizontal or inclined retorts are not suitable, and they, as well as coke-oven tars, should be distilled for the recovery of tar oil, and in this way brought into use as fuel for Diesel engines.

The specific gravity of coal tar is 1.06 to 1.12.

If the viscosity is over 20 deg. Engler at a temperature of 20 deg. C., the tar is unsuitable for good combustion.

With regard to flashpoint and water, the same remarks apply as to tar oils. It should, however, be carefully noted that when using tar as fuel, certain inconveniences will be experienced, and these will be considerably increased if the amount of water contained in the tar is high.

A thin layer of the fuel poured on to glass or paper should show the smallest possible quantity of black or crystallised deposits.

Tars with a calorific value below 15,500 B.TH.U. are of little use.

The ashes content should not exceed 0.1 per cent.

The sulphur content may be up to 2 per cent.

The impurities that remain after evaporation at 350 deg. C. should not exceed 45 per cent.

Mr. L. W. Johnson, of Messrs. Banks, Warner & Co., Ltd., referred to the entirely successful manner in which tar and tar oils had been used in Diesel engines in Germany. In that country the approximate total B.H.P. developed by Diesel engines was 850,000, of which about 150,000 was obtained from tar or tar oils, the corresponding figures for Great Britain being about 80,000 and 1,000 respectively. The lowest import duty on petroleum oils brought into Germany was 36s. a ton, which naturally was a great encouragement to the use of the home product.

A great saving of national wealth might be effected by the use in internal-combustion engines of fuel oil distilled from the coal produced in our own country as compared with the burning of coal in boiler furnaces; he estimated it at 30 million pounds sterling to the consumer per annum, whilst the value of the coal would be increased by fully 75 per cent.

Tar oils have so far chiefly been used for creosoting timber, and most of the available supplies are now sent to the United States; in 1913, 40 per cent. of our total production of tar was exported to America, the approximate amount being 200,000 tons, which would provide nearly a quarter of a million B.H.P. working 3,600 hours. A further large percentage was exported to Germany, and this now also goes to the United States. Lately, however, in America a number of tar distilling plants are being installed, which fact is of much importance to us.

The speaker stated that since the beginning of this year he had been in touch with most of the sources of supply of tar oils in this country, and that out of some 50 firms approached only about a dozen had been able to make any offers at all. Of these, about one-half could supply products which would be suitable for use in Diesel engines, and the total quantity would amount to about five to eight thousand tons per annum. The prices quoted ranged from 2½d. to 6d. a gallon, or, say, £2 10s. to £7 a ton at their works. It seemed probable that a further million gallons of suitable fuel oils could be supplied from other sources. The price of fuel oil suitable for Diesel engines on the Pacific coast of America was said to be 1d. per gallon, and on the Eastern coast of America 2d. per gallon. Owing to taxation of imports in Germany, tar oil had been cheaper to use than even Galician fuel; thus Diesel engines there had been developed to burn tar oils, and the exclusive use of inland fuels had tended to make Germany independent of foreign countries. The value of creating a home product lay in the fact that thereby competition was established with the foreign product, and prices were kept within reasonable limits.

A process for distilling tars obtained from gas works where vertical retorts were used had already been set to work in a neutral country, and the distilled oils were being used on Diesel engines of all sizes and of both low and high speeds with every success, and without the engines being altered for pilot ignition. In most cases, however, pilot ignition had been resorted to in one form or another, and it was only quite recently that any measure of success had attended the experiments made to use the oils without pilot ignition. The chief trouble experienced was that at lighter loads, *i.e.*, below three-quarter loads, the temperature inside the cylinder at the time of opening the fuel valve was not high enough to start and complete the combustion of the main charge.

Mr. Johnson referred to an engine of 150 B.H.P., which had been operating absolutely satisfactorily for about three years on ordinary gas works tar. No difficulties had been encountered, and pilot ignition was employed. Several engines had also been tested on distilled tar, and were operating successfully on this product without pilot ignition.

Of the various methods that had been tried for burning tar oils, only two were useful, namely, modifying the design of the fuel valve so as to produce the right conditions for tar oils, or using a pilot charge. The latter was at present the standard for running Diesel engines on tar oil, but the former appeared to be the correct one, as the problem of using tars and tar oils could not be considered solved until such oils could be burned as simply as residual oils. No conclusive results had as yet been obtained, and the whole principle being in its experimental stage, great secrecy was observed. The whole difference, however, appeared to be in the design and operation of the needle valve. What appeard to be required was that quite a small quantity of tar oil should enter the cylinder before, and distinct from, the main charge. This quantity was readily converted into the oil-gas formation necessary to raise the temperature in the combustion space sufficiently to permit of the smooth and complete burning of the main charge. Many experiments were carried out before conclusive evidence was obtained that the experiments were being made on the right lines and that results were possible.

It should be noted that copper, zinc, or alloys of these metals could not be employed in the manufacture of parts in contact with tar oils. Hence steel pipework must be adopted, and the parts of engines, which were generally made of gunmetal or phosphor bronze, had to be made of pure nickel or 25 per cent. nickel steel, while good joints could be made of sheet asbestos after soaking it in gold size or some like substance.

In the discussion which followed, much stress was laid on the advantage which would accrue to users of Diesel engines in this country if they were not in future to be left entirely dependent upon the use of imported petroleum fuel oils. The importance of the question from the national point of view, particularly in the more economical utilisation of the mineral resources of the country, was also referred to.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

CHILE.—Telegraphic information has been received at the Board of Trade, through the Foreign Office, to the effect that the proposed new specific Customs Tariff for Chile has been introduced in the Senate, and will, it is anticipated, be passed by that body very shortly and promulgated as law, in the form sanctioned by the Chamber of Deputies, with some few modifications. A translation of the proposed new Tariff, as approved by the Chamber of Deputies, was issued in 1914 as

a Parliamentary Return (Cd. 7,458), obtainable from Wyman and Sons, Fetter Lane, London, E.C.

TRINIDAD AND TOBAGO.—The Board of Trade have received the copy of a Resolution which was agreed to on December 10th, 1915, by the Legislative Council of Trinidad and Tobago, amending the duties on certain articles imposed by the Customs Duties Ordinance of 1913 on their importation into the Colony. Among the amendments may be noted the following:—

The duty on machinery—including motor and other engines, steam boilers, and electric machinery *not hereunder specified* (see below), and electric dental appliances, remains the same, viz., 8 per cent. *ad. val.* under the preferential tariff, and 10 per cent. *ad val.* under the general tariff, but the italicised words are new.

The following have been transferred from the free schedule and now have to pay a uniform rate of 2½ per cent. *ad val.*, viz.:—Machinery for electric lighting and power plant on estates or mines (and parts thereof not imported for sale) if admitted as such by the Collector of Customs; machinery for railways and tramways on estates or mines, including rails and rolling stock (and parts thereof, not imported for sale), admitted as such by the Collector of Customs; also agricultural, irrigation, mining, &c., machinery, not imported for sale. Motor vehicles of all kinds, which formerly paid varying specific rates of duty, are now dutiable at the uniform rate of 8 per cent. *ad val.* under the preferential tariff and 10 per cent. *ad val.* under the general tariff.

NETHERLANDS.—The exportation from the Netherlands of rubber, gutta-percha, and articles manufactured therefrom was prohibited by a Royal Decree promulgated on January 26th.

GREECE.—In virtue of a Greek Royal Decree of October 31st last, certain tools, machinery, instruments, and utensils of agriculture and the branches of industry connected therewith, when imported into Greece by Agricultural Associations for their own use or for sale or loan to members of an Association, are to be exempted from import duty, also from municipal, communal, harbour, or any other tax. In the list of implements and machinery specified in the Decree appear the following:—Motors of agricultural machines, *i.e.*, motors worked by horse, steam, or electric power, crude petroleum and benzine (petrol) motors; means for the conveyance of motive power, *i.e.*, belts, cogged wheels, chains and wire for transmitting electric power; and pumps.

UNITED STATES OF AMERICA.—A Circular recently issued by the United States Treasury Department contains the text of revised regulations, which came into force on February 1st, regarding the procedure for the exportation of merchandise to foreign countries or shipped to or from non-contiguous territory of the United States. The full text of the Circular, which gives detailed instructions with regard to various export matters, may be consulted at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

BRITISH DOMINIONS AND COLONIES, &c.—Information relating to the rates of import duty leviable in the British Self-Governing Dominions, Colonies, Possessions, and Protectorates is contained in the Return recently published by the Board of Trade on "Colonial Import Duties, 1915." The Return is arranged with the object of bringing together the various tariff classifications and rates of duty for each principal group of articles, the information being shown for each British Possession under each group. Electrical machinery and apparatus (including wireless telegraphy) forms one of the headings into which the groups are divided. Other particulars included in the Return are details of the preferential tariff advantages accorded in certain Dominions and Colonies in favour of British goods; information respecting tariff valuations, the levying of duties on the gross or net weight of goods imported at specific rates; tare allowances; Colonial copyright laws and regulations; parcel post regulations affecting dutiable articles sent from the United Kingdom; and a detailed statement of the *export* duties leviable in the various Dominions and Colonies, &c. The Return is obtainable from Messrs. Wyman & Sons, Ltd., Fetter Lane, E.C., reference number Cd. 8,094, price 4s. 2d., post free 4s. 9d.

NEW PATENTS APPLIED FOR, 1916.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

2,920. "Means of control for petrol-electric cars." W. A. Stevens. February 28th.

2,924. "Means for controlling the ignition period in magneto-electric machines." H. Green. February 28th.

2,945. "Electrical contacts." M. W. F. Petmeky & A. W. Sherriff. February 28th.

2,959. "Feed-pump pressure regulators." British Thomson-Houston Co. February 28th.

2,961. "Electrolysis of solutions of alkali chlorides." W. T. Gidden. February 28th.

2,968. "Galvanic batteries." G. Fuller, G. J. A. Fuller, & L. Fuller. February 28th.

2,976. "Variable capacity for wave-transmission systems." W. Haddon. February 28th.

2,977. "Electric heaters." E. C. R. Marks (Landers, Frary & Clark). February 28th.

2,986. "Electric cables." Callender's Cable & Construction Co. and T. O. Callender. February 28th.

3,006. "Ships' telegraphic apparatus, &c." E. A. Lambert. February 29th.

3,029. "Electric battery lamp." J. E. Hamilton. February 29th.

3,036. "Polyphase alternating electric current commutator machines." British Thomson-Houston Co. & N. Shuttleworth. February 29th.

3,052. "Electric condensers." M. O'Gorman & R. Whiddington. March 1st.

3,057. "Magneto electric machines." H. Green. March 1st.

3,059. "Cleat for carrying two separate wires or cables." J. E. Grocott. March 1st.

3,062. "Sparking plugs for internal-combustion engines." A. T. Austin. March 1st.

3,067. "Electric furnaces." H. Etchells & H. A. Greaves. March 1st.

3,076. "Electric welding or fusion-deposition of metals." A. P. Strohmenger. March 1st.

3,084. "Electrolytic production of sodium perborate." Deutsche Gold-und Silber-Scheideanstalt vorm Rossler. March 1st. (Germany, March 10th, 1915.)

3,087. "Electric switches, especially for controlling electric motors." P. S. Brook & J. A. Hirst. March 1st.

3,088. "Method of reducing electrode consumption in electric steel-melting furnaces." V. Stobie. March 1st.

3,099. "Electrolytic production of sodium perborate." Deutsche Gold-und Silber-Scheideanstalt vorm Rossler. March 1st.

3,114. "Means for regulating voltage of direct-current dynamo." E. Schneider. March 1st.

3,122. "Magneto-electric machines." F. L. Hollister. March 1st.

3,161. "Battery cells." W. L. Walker. March 2nd. (U.S.A., March 17th, 1915.)

3,164. "Means for suspending and insulating electrical conductors." H. A. Ewen & Marconi's Wireless Telegraph Co. March 2nd.

3,165. "Studs or electrodes of electric dischargers." H. M. Dowsett and Marconi's Wireless Telegraph Co. March 2nd.

3,166. "Aeroplanes." Marconi's Wireless Telegraph Co. March 2nd.

3,169. "Apparatus for heating air or gases." British Thomson-Houston Co. March 2nd.

3,192. "Dynamo-electric machines." H. Chitty. March 2nd.

3,227. "Earthed concentric electric wiring systems." G. S. Boothroyd and Callender's Cable and Construction Co. March 3rd.

3,230. "Driving mechanism for machines." British Thomson-Houston Co. (General Electric Co.). March 3rd.

3,233. "Measuring instruments, relays, &c." H. A. Ewen & Marconi's Wireless Telegraph Co. March 3rd.

3,234. "Dynamometers." W. G. Walker. March 3rd.

3,254. "Electrical measuring apparatus." F. Wunsch. March 3rd. (U.S.A., March 4th, 1915.)

3,255. "Voltage regulating systems for electrical circuits." R. E. Gilmor (Sperry Gyroscope Co.). March 3rd.

3,286. "Electric cable drums, reels, &c." E. Edwards & H. G. Woods. March 4th.

3,294. "Electric incandescent arc devices." British Thomson-Houston Co. (General Electric Co., U.S.A.). March 4th.

3,298. "Electric switches." A. H. Midgley and C. A. Vandervell & Co. March 4th.

3,299. "High-tension magnetos." A. H. Midgley and C. A. Vandervell and Co. March 4th.

PUBLISHED SPECIFICATIONS.

1914.

1,405. Continuous-current Generators. Fried. Krupp Akt. Ges. January 19th. (January 31st, 1913. Addition to 1,407/13.)

12,282. Polyphase Commutator Dynamos and Motors. A. Heyland. May 18th. (June 14th, 1913.)

23,107. Electrical Switches. F. B. Cox & Smith. November 26th. (Addition to 23,162/12.)

1915.

596. Automatic Electro-dynamic Brake System for Feed Reels and the like. H. V. James. January 14th.

1,076. Heating Unit or Resistance Element for Electric Heating Apparatus. A. Slatter & G. Wilde. January 22nd.

2,250. Convertible Electric Fire. E. A. Welch. February 12th.

2,312. Electrical Heating Apparatus. A. F. Berry. February 12th.

2,328. Electric Switches or Devices for Making or Breaking Electric Contacts. F. A. Humphreys, B. A. Quint, & E. J. Felt. February 13th.

2,532. Controllers for Electric Lifts. C. G. Major & Smith, Major and Stevens, Ltd. February 17th.

2,618. Dynamo-electric Machines. Crompton & Co., and N. Pensabene. February 18th.

2,696. Tubular Electric Pocket Lamps. E. C. R. Marks (Interstate Novelty Co.). February 19th.

2,698. Method of rendering articles made of Porcelain, Pottery, Glass, and the like, Electrically Conductive for the purpose of enabling the Deposition thereon of Metallic Coatings by Electrolysis to be effected. P. Marino. February 19th.

3,987. Printing Telegraph Receivers. Western Electric Co. (A. F. Dixon). March 13th. (March 19th, 1914.)

5,351. Electrically-heated Hot-air Syringe for Dental or Surgical use. J. M. Vaughan. April 9th.

7,704. Telephone Systems. Relay Automatic Telephone Co. & L. C. Bygrave. May 22nd.

9,279. Targets for X-ray Tubes and the like. British Thomson-Houston Co. (General Electric Co., U.S.A.). June 24th.

11,818. Electrolytic Refining of Tin. W. J. Mellersh-Jackson (American Smelting & Refining Co.). August 16th.

12,892. Electric Lock Switches. G. W. Bowen. September 8th.

12,951. Electro-magnetically Controlled Valves for use in connection with the Electro-pneumatic Actions of Organs. H. Willis, Jun. September 9th.

13,985. Dynamo-electric Machines for the Starting and Ignition of Internal-combustion Engines. British Westinghouse Electric & Manufacturing Co. October 2nd. (October 3rd, 1914.)